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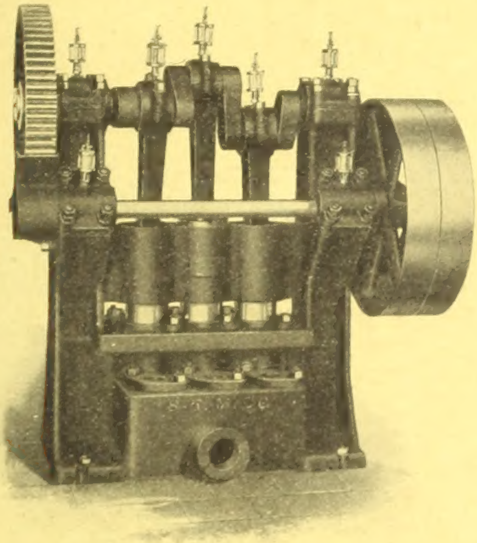
Vol. 28 Toronto, April 1, 1914 No. 13

ESTABLISHED 1886

Contract Record and Engineering Review

Before you buy your Pumping Machinery, write us for our catalogue, covering Steam and Power Pumps



The Smart-Turner Machine Co., Ltd., Hamilton, Canada

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited

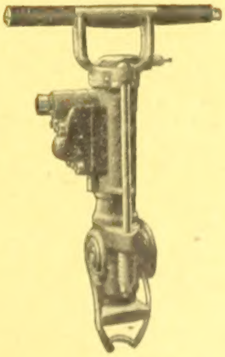
(HILL & RUTHERFORD, Managing Directors)

Head Office and Works: 91 to 133 Don Roadway

TORONTO

THE "JACKHAMER"

is self-rotating, self-lubricating and it is an all-steel drill operated by steam or air.



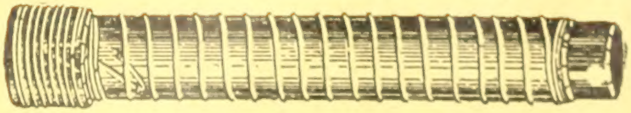
A "One-Man Drill"

which will make a decided reduction in your drilling costs. The drill you are looking for.

A Copy of K-68 will interest you. Ask us for it.

Canadian Ingersoll-Rand Co., Limited

MONTREAL, CAN.



Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

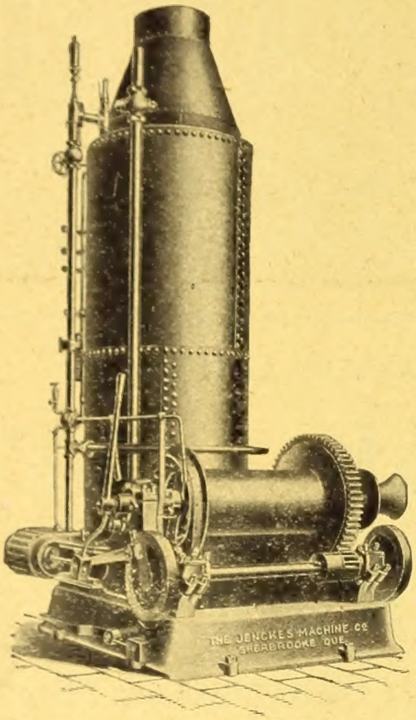
P. O. Box 563 Vancouver, B. C.

Office and Factory, Granville St., near High Bridge

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6



Hoisting Engines

¶ To the Contractor who wants a good reliable and efficient hoisting engine,—one that will always be right on the job—we suggest an inquiry into our wide range of this type of machine.

Any one of our offices will help you find the engine best suited to your needs.

The JENCKES MACHINE COMPANY, Limited
General Offices: SHERBROOKE, QUE.
Works: Sherbrooke, Que. **St. Catharines, Ont.**
Sales Offices: Sherbrooke, St. Catharines, Nelson, B.C. Vancouver, Montreal, Cobalt, S. Porcupine

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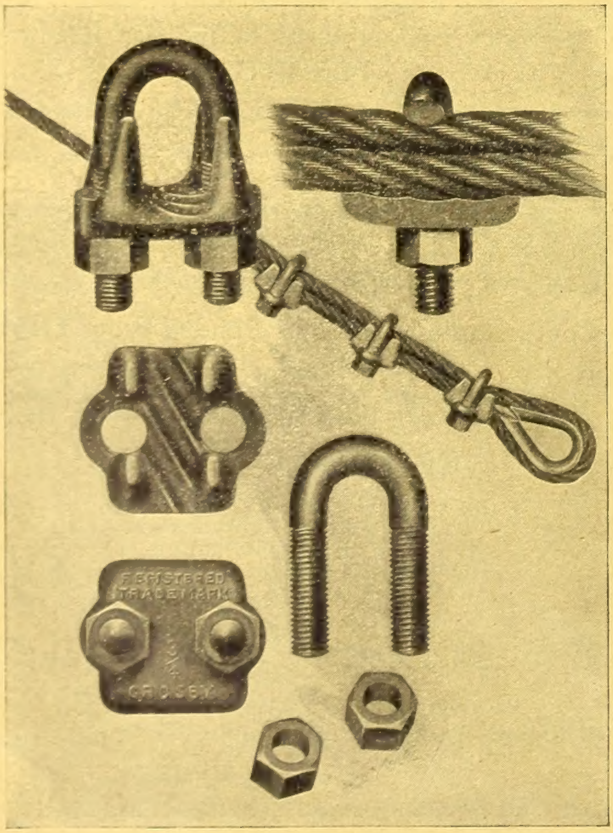


"CROSBY" CLIPS ALL WAYS, ALWAYS

The one absolutely secure and dependable wire rope fastening is the drop forged steel, galvanized

"CROSBY" CLIP

Built for greatest gripping power—immune to rust.

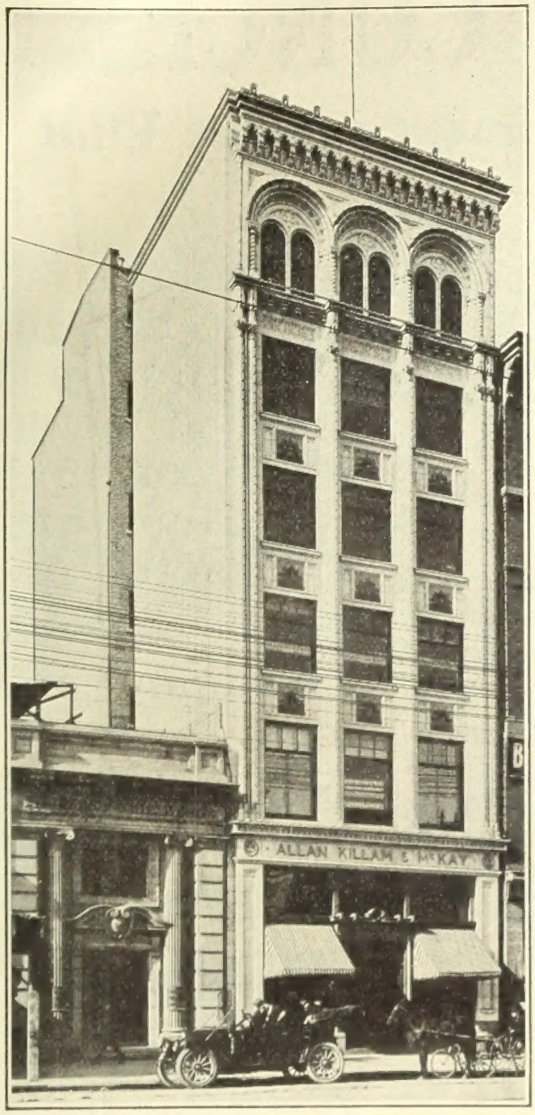
IT HOLDS

In the interests of safety use no other on guy or hoisting lines.

MADE BY

American Hoist & Derrick Co.
ST. PAUL, MINN.

SOLD BY—General Supply Co., of Canada, Ltd. Montreal, Ottawa, Toronto, Canada. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta. and Nelson, B.C.



Reinforced concrete office building of Allan, Killam & McKay, Winnipeg, Man., Agents for Allan Line Steamships—Architects: J. D. Atchison & Co., Contractors: Hazelton & Walin, Limited. Canada Cement used exclusively.

The Adaptability of Concrete to Buildings

The fact that concrete may be moulded into almost any form, makes its use particularly advantageous in buildings necessitating special construction.

Its great strength, economy and durability, combined with almost unlimited possibilities in obtaining artistic effects, destines it to become the ultimate standard for office building construction.

Concrete buildings are fire, water and vibration proof. They reduce cost of maintenance to the minimum., They enable greater window area and consequently more inside light.

We have complete information regarding every class of concrete building construction that will be sent to architects, engineers and contractors upon request. This information will prove valuable in preparing plans for other buildings.

Information Department

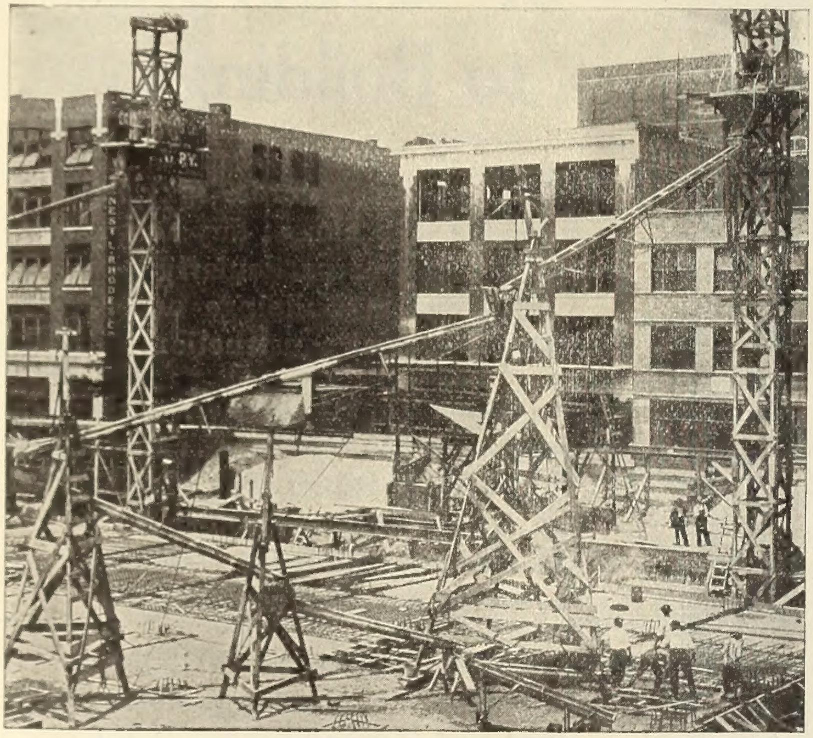
Canada Cement Company

Limited

886 Herald Building, Montreal

IN PLACING CONCRETE

The selection of Equipment is Most Vital

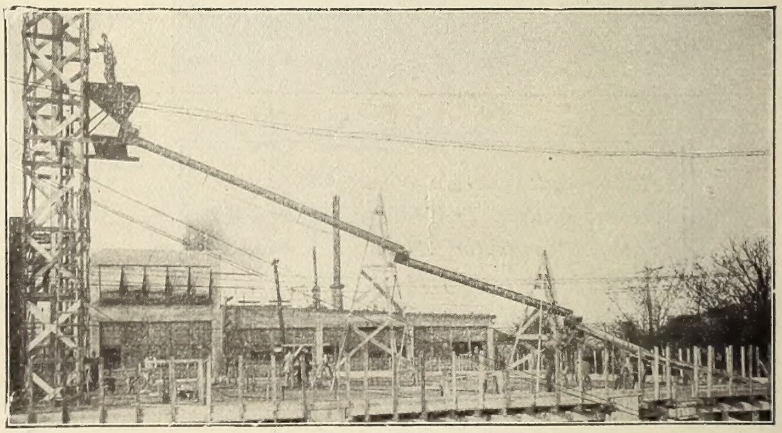


A mistake means loss. The Insley method is the method of greatest economy regardless of the character of the work.

Economy in first cost.

Saving in time.
Saving in operating cost.

For a compact flexible plant and a clear floor on buildings or for long distance spouting on bridges and dams.



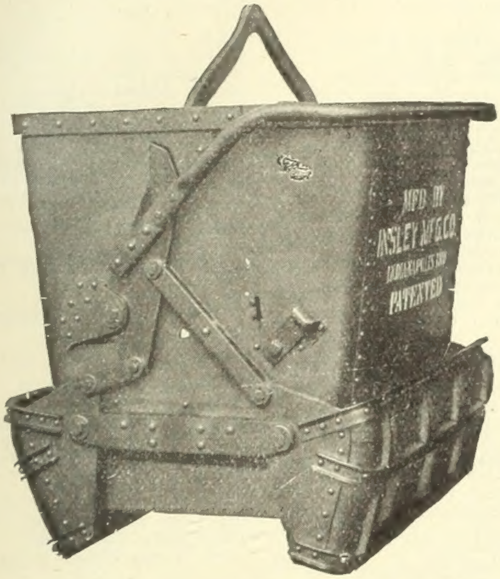
Mussens Limited

MONTREAL 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.

QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

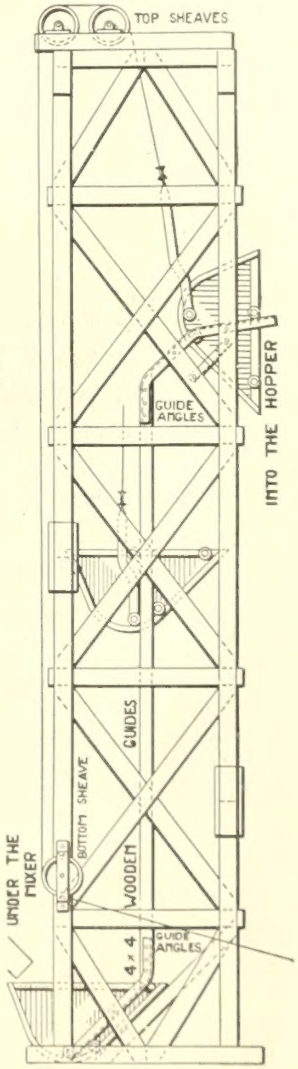
INSLEY PLANT

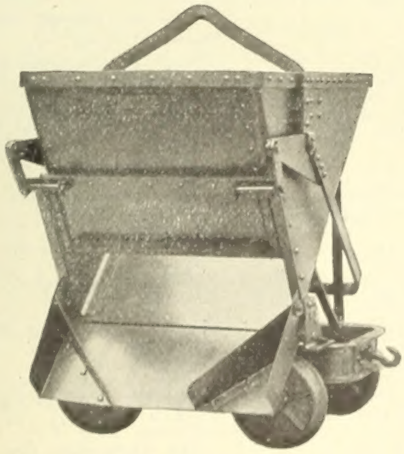


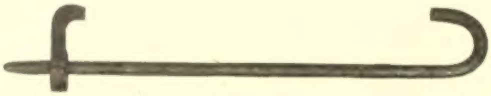
Means an economical way of handling your concrete.

Complete Line of

BUCKETS
CARS
SKIPS
HOISTS
CLAMPS
DERRICKS
RECEIVING
HOPPERS
ETC.







Catalogue Sent on Request

Mussens Limited

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QUEBEC, 31 St. Louis St.
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HALIFAX, 78 Granville St.

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The following regulations apply to all advertisers:—Eighth page, two headings quarter page, four headings; half page, eight headings; full page, sixteen headings.

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  - Canadian Concrete Appliance Co.
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  - Sutcliffe, Speakman & Co.
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- Culverts
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  - Sturtevant Co. of Can. Ltd. B. F.
- Dump Cars, Wheels, etc.
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  - Manitoba Bridge & Iron Works.
  - Schell Foundry & Machine Co.
  - Western Wheeled Scraper Co.
  - Weller Mfg. Co.
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- Dump Carts and Wagons
  - Deere Plow Co., John.
  - Troy Wagon Works
- Electric Air Rock Drills
  - Canadian Ingersoll-Rand Co.
- Electrical Machinery and Supplies
  - Ferranti Electrical Co.
  - Sturtevant Co. of Can. Ltd. B. F.
- Electric Fans
  - Sturtevant Co. of Can. Ltd. B. F.
- Elevators
  - Roelofson Elevator Works.
- Enamelled Brick
  - American Enamelled Brick & Tile Company
- Engines
  - Boving Company of Canada
  - Canadian Buffalo Forge Co.
  - Canadian Sirocco Co.
  - Inglis Co., John
  - Jenckes Machine Co.
  - Laurie & Lamb
  - Leonard & Sons, E.
  - McDougall Caledonian Iron Wks.
  - Mussens Limited
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  - Dominion Engineering & Inspection Company.
  - Farmer, John T.
  - Galt Engineering Co., John
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  - Mitchell, C. H.
  - Thorold Co., F. W.
  - Tyrrell, H. G.
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  - Brown Hoisting Machinery Co.
  - Municipal Engineering & Contracting Company.
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- Expanded Metal
  - Mannesmann Tube Co.
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- Exhaust Heads
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- Fans
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  - Sturtevant Co. of Can. Ltd. B. F.
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(Continued on page 12)

Built for C.P.R. Montreal

Canadian Plant

Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.
We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

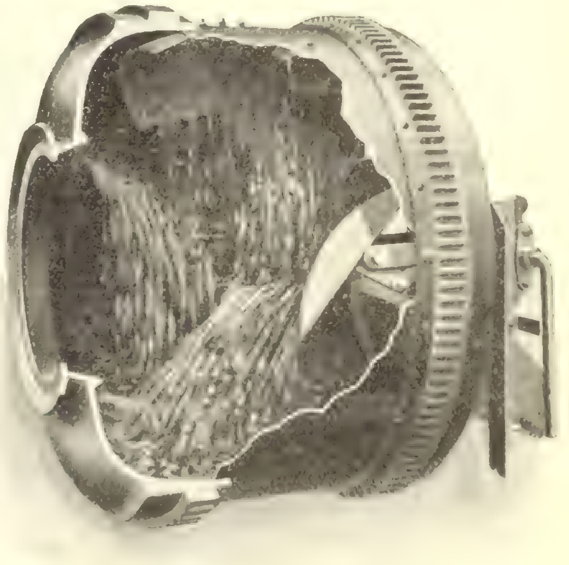
OFFICES : **Bridgeburg, Ont., 130 Janet St.**
Chicago, Ill., 1360 W. 105th St.

SHOPS : **Bridgeburg, Ont.**
Chicago, Ill.
Greenville, Pa.

KOEHRING CONCRETE MIXERS

Owing to the construction of the drum here shown there are three independent mixing actions constant and opposed to one another, with a continual intermingling of all the material in the drum, and practically three times as much mixing, which means practically three times as fast mixing, as would be possible with any one of these actions alone.

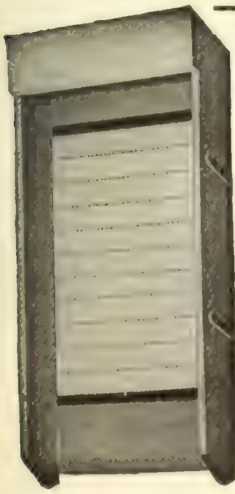
There is an important point also in the fact that mixers depending for their mixing action on a single series of blades, scoops or faces of the drum produce a series of flows in which the fine gravitates to the bottom of the mass, and the coarse remains on top. This is entirely overcome in the Koehring principle of three independent and opposed actions producing a perfect intermingling of the entire batch, and therefore absolute uniformity of product.


Cut-away view of the Koehring drum, illustrating the Koehring matchless three-in-one principle in mixing. Note how the discharge chute when in mixing position aids in the mixing operation.

CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturers of Air Compressors, Avery Stokers, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Lidgerwood Engines and Cableways, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Pipe, Water Wheels.

HEAD OFFICES: TORONTO. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver,, Victoria, Prince Rupert.



NOW is the time to renew your

SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
Hamilton

AN OPPORTUNITY

Local Agents Wanted in
Quebec, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

Water Filters
1,000 to 1,000,000 Gallons a Day

Refrigerating Machinery
1-4 to 60 Ton Daily Capacity

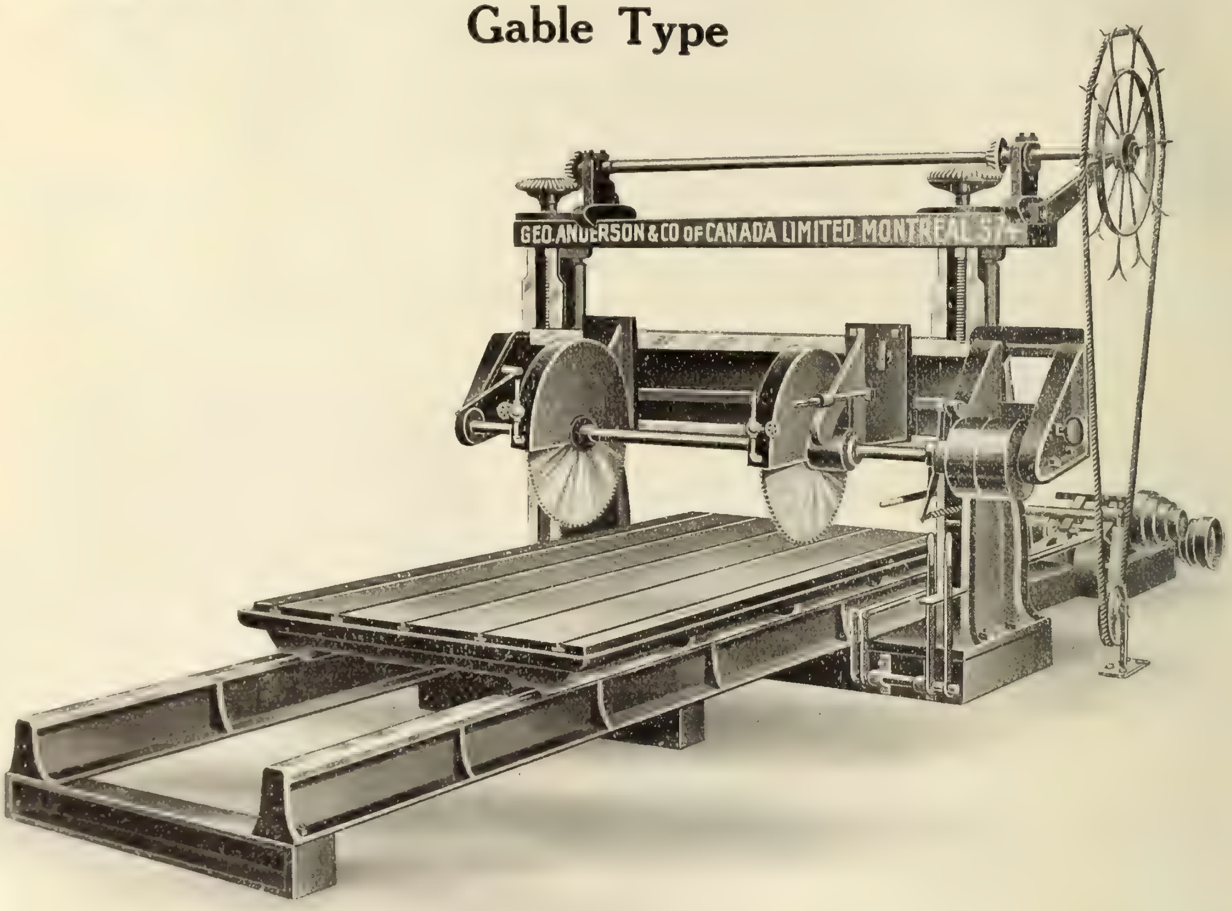
Water Purifiers
4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED
302 McGILL BLDG., MONTREAL, P. Q.

Duplex Diamond Saw

Gable Type


GEO. ANDERSON & CO OF CANADA LIMITED MONTREAL

The cutting capacity of this machine, fully loaded, with fast feed speed is 160 superficial feet per hour.

This machine is specially suitable for *Monumental Stones, Tiles, Details.*

We Also Manufacture

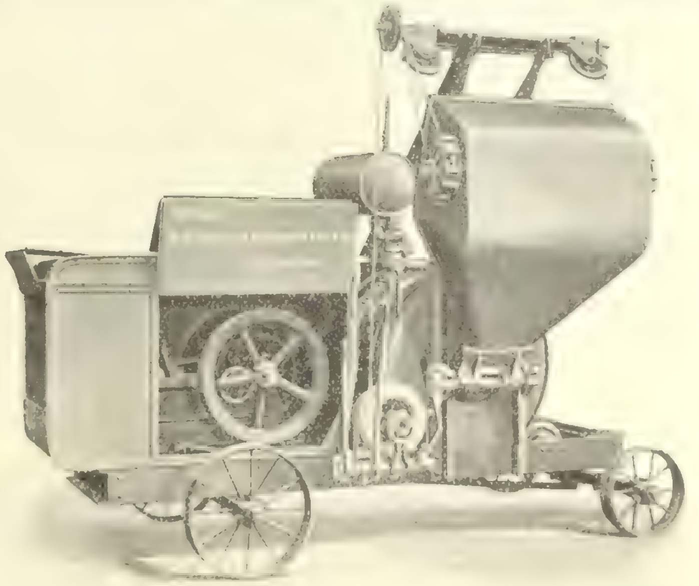
Cranes and Derricks

Geo. Anderson & Co. of Canada, Limited

Montreal, Que. and Carnoustie, Scotland

ANNOUNCEMENT

Most Mixing



Least Fixing

It is with much satisfaction that we announce to the contractors and builders of Canada our recent connection with the Marsh-Capron Mfg. Co., of Chicago. Knowing full well the heavy demands placed upon a concrete mixer in Canada we spared no effort to determine which, in our estimation, was the best mixer built. As a result of this investigation we are proud to offer

THE M-C RAIL TRACK MIXER

Equipped with Fairbanks-Morse Gasoline Engines

There are several hundred of these mixers in successful operation in Canada—there were five used on the big C. P. R. irrigation job at Bassano, Alberta. We carry a complete stock of all sizes and equipment at our several warehouses and are always in a position to make immediate shipments quick.

Write our nearest branch

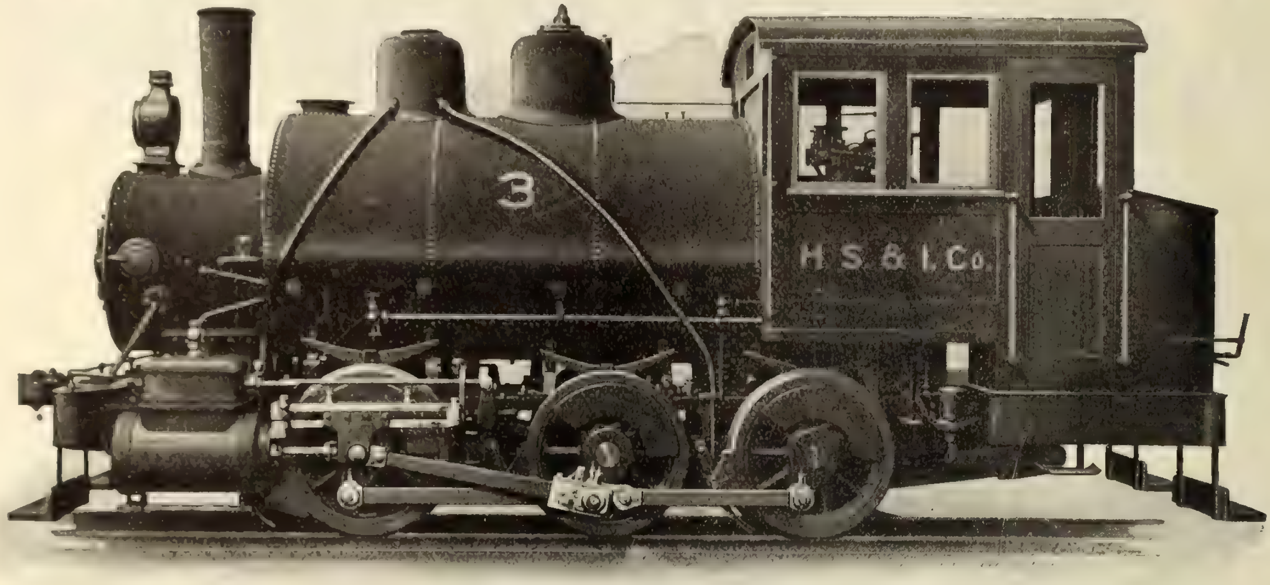
CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

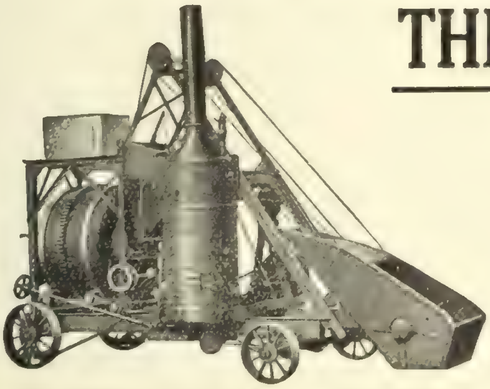
Keep the following Names in Mind when Ordering High Grade Brick.

- Beaver Clay Mfg. Co.
- Columbus Brick and Terra Cotta Co.
- Hydraulic-Press Brick Co.
- Hocking Valley Fire Clay Co.
- Kushequa Brick Co.
- Ohio Mining & Mfg. Co.
- Pearl Clay Products Co.
- Tiffany Enameled Brick Co.

BLACK BUILDING SUPPLY CO., LTD. - TORONTO

WHY are we the Largest Manufacturers of Concrete Machinery in Canada ?

THERE MUST BE A REASON



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

The reason is that our machines have always been made up to a standard, not down to a price. This fact has been recognised by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

London Concrete Machinery Company, Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:

WINNIPEG (445 Main St.) W. H. Rosevear, Mgr.
CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.
TORONTO (112 York St.) F. D. Emsley, Mgr.
HALIFAX (68 Upper Water Street) R. R. Power, Manager

AGENCIES:

OTTAWA, The General Supply Co. of Canada
VANCOUVER, B. C. Equipment Co.
FORT WILLIAM, Northern Eng. & Supply Co.
MONTREAL, Foss & Hill Mach. Co.
QUEBEC, A. D. Masson

The Constructor Says

"The world is surely getting better.

This morning I saw ten houses under construction, each by a different builder.

Each house had cement stucco forming part or all of the outside wall. In every case the stucco was applied on Herringbone Metal Lath. Ten years ago it would have all been on wood lath.

Every one now knows that the only way to prevent buckling of lath in walls exposed to sun and rain is to use Herringbone Metal Lath."

Clarence W. Noble, ***General Sales Agent***

Winnipeg 117 Home Life Building, TORONTO Montreal

The Metal Shingle & Siding Company, Manufacturers

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Field Instruments
- Gurley, W. & L. E.

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Fire Brick
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- [illegible] & Ryan

Fire Escapes
- Manitoba Bridge & Iron Works
- McGregor & McIntyre

Fireproof Doors and Windows
- [illegible] & [illegible]
- Hope & Sons, Henry.
- Mussens Limited
- Pedlar People Limited.
- Steel & Radiation Limited

Fuse (Safety Blasting)
- Lecky & Collis

Fixtures (Gas)
- Consumers Gas Co.

Folding Doors
- Springer, O. T.

Forges
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Canadian Sirocco Co.

Forgings
- Canadian Billings & Spencer, Ltd.

Gas Engines
- Armstrong Mfg. Co.
- British Mfrs. Assn. of Canada.

Gasoline Engines
- Armstrong Mfg. Co.
- Original Gas Engine Co.
- Wettlaufer Bros.

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- Consolidated Glass Co.
- Hobbs Mfg. Co.
- Luxfer Prism Co.
- Toronto Plate Glass Imp't'g Co.

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Hammer Drills
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High Pressure Pipe Lines
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- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
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- Mussens Limited
- Royce Limited
- Sturtevant Co. of Can. Ltd., B. F.

Heating Apparatus
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Sheldons Limited

Hoisting Engines
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Wettlaufer Bros.

Hydrants
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

Ice-making Machinery
- Linde British Refrigeration Co.

Insulating Compounds
- Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
- Batts Limited
- Canada Office & School Fur. Co.
- Rhodes Curry & Co.

Jib Cranes (all kinds)
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Kilns
- Canadian Buffalo Forge Co.
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Lime
- Dominion Lime Company.
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Mechanical Draft Apparatus
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Metal (Anti-Corrosive)
- Stark Rolling Mill Co.

Metal Lath
- Greening Wire Co., B.
- Metallic Roofing Co.
- Noble, C. W.
- Pedlar People Limited.
- Steel & Radiation Ltd

Meters, Electrical
- Ferranti Electrical Mfg. Co.
- Canadian Allis-Chalmers, Ltd.

Meters, Water
- Hopkins & Co., F. H.
- McDougall Caledonian Iron Wks
- Neptune Meter Co.

Overhead Runways
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Paints and Varnishes
- Dominion Paint Works
- Hopkins & Co., F. H.

Paints (Bridge and Structural Iron and Pipe Coating)
- Dominion Paint Works

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Ferranti Meters

THE smallest amount of current on the heaviest load is accurately measured on a Ferranti meter. Our meters are guaranteed for three years against all mechanical or electrical defects.

Ferranti meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

Illustration shows our improved type "C" meter, single or polyphase; top or bottom connections; clock or cyclometer dials.

A postal card will bring complete particulars on Ferranti meters.

The Ferranti Electrical Co. of Canada, Ltd.

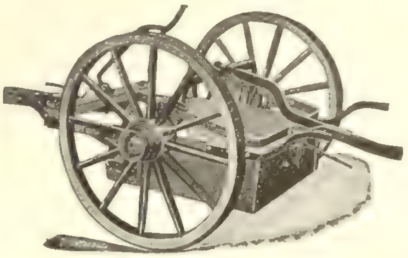
90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM" TOOLS
It is plain to be seen
you are
losing money

Abram Cement Tool Co.,
Windsor, Ontario

W In a class W


S by themselves Co.

Western Wheeled Scrapers

are acknowledged by contractors and others to be the only practicable and durable wheeled scrapers made.

No other scraper has the heavy construction, spring back hooks, and reversible sleeve spindles and sand caps of the Western.

We have a catalogue waiting for you—send us your name and address.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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  - Aztec Oil Asphalt Co
  - Baker Co., R. D.
  - Barber Asphalt Paving Co.
  - Dominion Creosoting Company
  - Ontario Asphalt Block Co.
  - Paterson Mfg. Co., B.
- Perforated Metals
  - Canada Wire & Iron Goods Co.
  - Greening Wire Co., B.
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  - Alabastine Hardmortar Co.
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  - Dietrich Limited
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  - Dore & Fils
  - General Car & Mach. Works
  - Lecky & Collis
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- Revolving Stone Screens
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  - Asbestos Mfg. Company
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- Sewer Pipe
  - Britnell & Company
  - Canada Iron Corporation
  - Dominion Sewer Pipe Co.
  - Gartshore Thomson Pipe Co.
  - National Iron Works
  - Nova Scotia Clay Works Ltd.
  - Ontario Lime Co., Ltd.
  - Ontario Sewer Pipe Co.
  - Smyth & Ryan
  - Standard Clay Products Ltd.
- Sewer Trenching
  - Lecky & Collis
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- Stains, Shingle, Cement & Brick
  - Cabot, Inc., Samuel
- Stair Builders
  - McGregor & McIntyre

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What Big Contractors

Say About This Koppel Car

Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

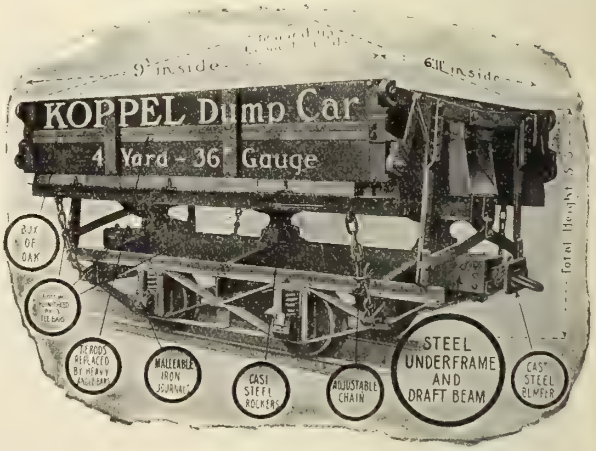
Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria



Capacity 4000 Tons Daily

Crushed Stone

For all purposes
Any size
Any quantity
We ship promptly
Let us quote you prices on your requirements.

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

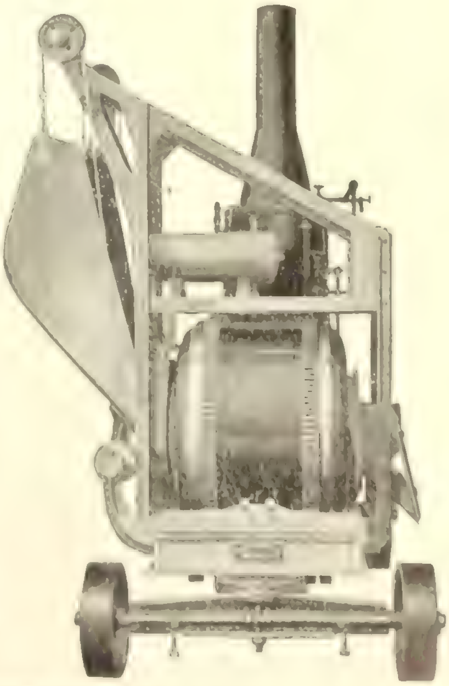
Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.



KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

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Smoke Stacks
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DesMoines Bridge & Iron Co.
Hamilton Mfg. Co., Wm.
Manitoba Bridge & Iron Works.
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Walsh Plate & Structural Works

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Mannesmann Tube Co.

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Lecky & Collis

Swinging Gears
Dake Engine Company

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Chicago Bridge & Iron Works
Hamilton Mfg. Co., Wm.
Inglis, John
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Manitoba Bridge & Iron Works.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
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Mannesmann Tube. Co.

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Canadian Billings & Spencer, Ltd.

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Dietrich Limited

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Canadian Buffalo Forge Co.
Canadian Sirocco Company
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.
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Vacuum Cleaners
Tuec Company

Varnishes—Insulating
Standard Underground Cable Co. of Canada, Ltd.

Wall Board
Bird & Son

Waterproofing
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Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Ceresit Waterproofing Co.
Wadsworth Howland & Co., Inc.

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American Water Softener Co.
Equipment & Supplies, Limited.
Manitoba Bridge & Iron Works.

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Mueller Mfg. Co., H.

Water Turbines
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Boving Company of Canada
Escher Wyss & Co.
Hamilton Mfg. Co., Wm.
McDougall Caledonian Iron Wks.

Well Drilling Machinery
Armstrong Manufacturing Co.

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Imperial Wire & Cable Co.
Standard Underground Cable Co. of Canada, Limited

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Greening Wire Co., B.

Wire Rope
Canada Wire & Cable Co.
Greening Wire Co., B.

Wrenches
Canadian Billings & Spencer, Ltd.

Wrenches
Can. Billings & Spencer, Ltd.

Contractors' Equipments

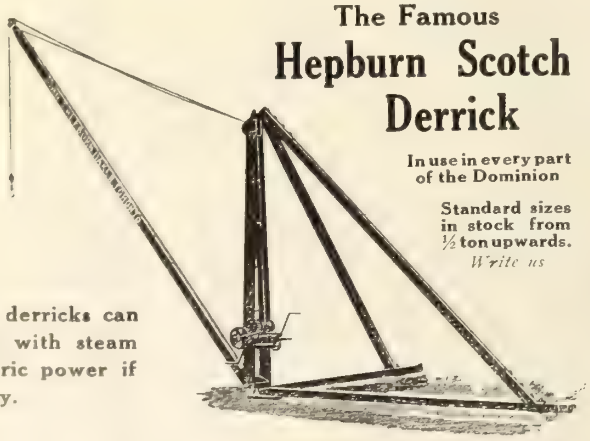
We manufacture Electric Overhead Cranes, Electric Derricks, Winches, and Capstans. Also Hand Winches Tripods, Breast Derricks, Chain and Leg Lewises, Stone Hooks, Post Caps and Bases.

The Famous

Hepburn Scotch Derrick

In use in every part of the Dominion

Standard sizes in stock from ½ ton upwards.
Write us



These derricks can be fitted with steam or electric power if necessary.

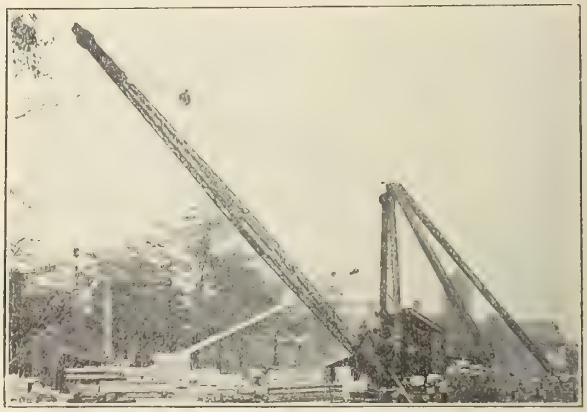


Illustration of Electric Derrick. 6 tons capacity. Boom 65 feet. Steel Boom and Steel Mast.

John T. Hepburn, Limited

IRON FOUNDERS, CRANE MAKERS AND MACHINISTS

18-40 Van Horne Street - - Toronto

Tarvia

Preserves Roads
Prevents Dust~

Eaton Road, Islington, Ont., Canada. Treated with "Tarvia A". This is one of the heaviest traveled roads leading out of Toronto, and carries a great amount of steel-tired vehicular and motor traffic.

English Approval

The processes for protecting roads by the use of tar materials against too rapid attrition by automobile traffic came into use in England about the same time that they did in the United States and Canada, but the English macadam road traffic is even harder than ours owing to the use of traction trains and heavy traction engines on the roads.

The popularity of the tar treatment with English engineers is demonstrated by a glance at a typical list of specifications issued by the Road Board. A list printed in the London Surveyor recently shows a total area to be treated by special tar processes of *over two million square yards.*

In Canada Tarvia has been very successful as a road binder. It is a product of the scientific combination of refined coal tars especially prepared for use on roads. Unlike crude tar, it is even in consistency for a given grade, presents no difficulties in heating and handling, is uniform in character and can be relied upon to be exactly the same from year to year.

The Tarvia treatment encloses the stone in a tough, durable, waterproof matrix, from which automobile traffic or water erosion will not tear it loose.

It brings about such economies in maintenance that the cost of the Tarvia is more than paid for.

Tarvia is made in three grades: "Tarvia X" for new or rebuilt roads and pavements, "Tarvia A" for surface application, and "Tarvia B" for dust prevention and road preservation.

Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER

THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N.B. HALIFAX, N.S. SYDNEY, N.S.

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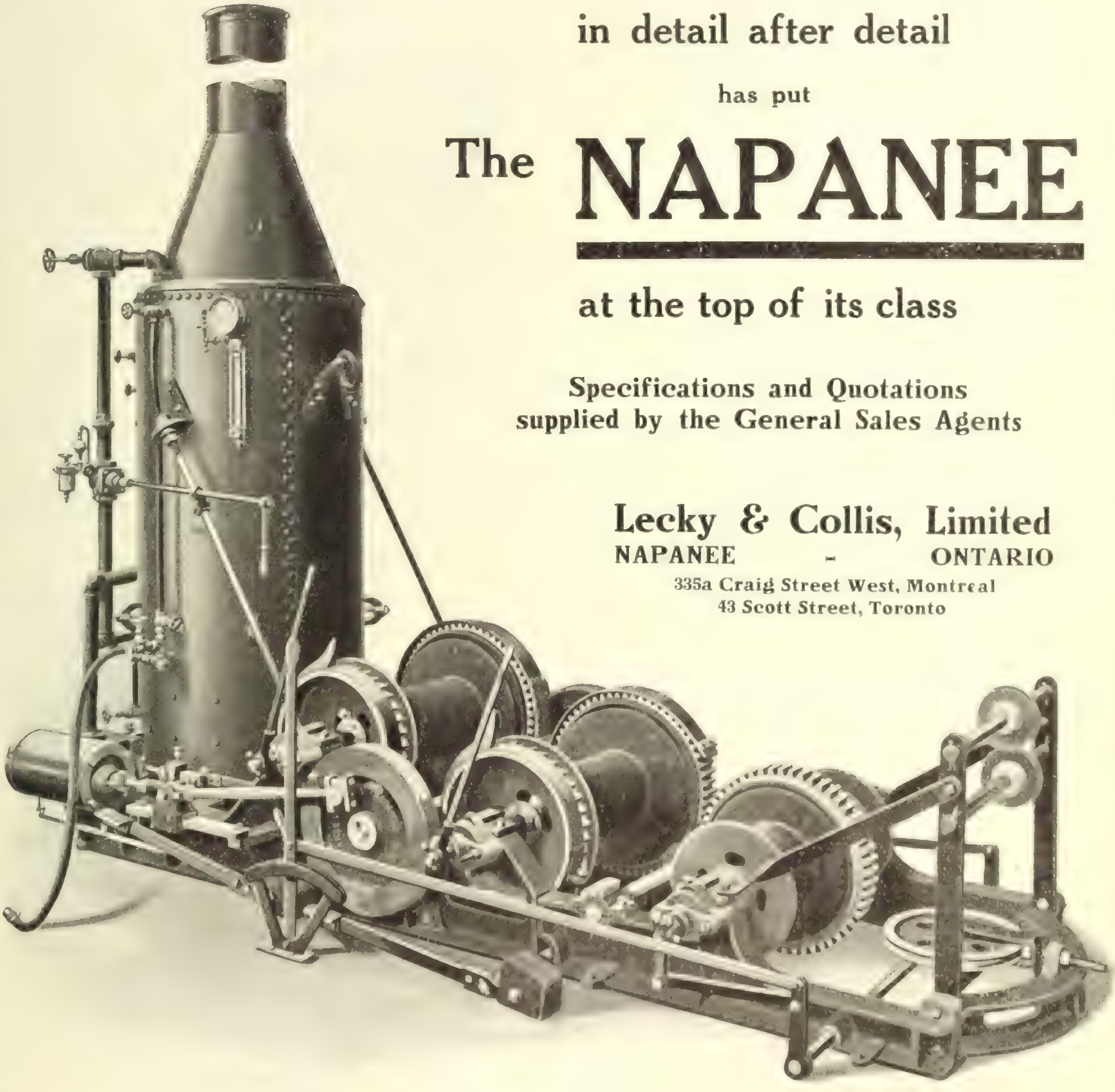

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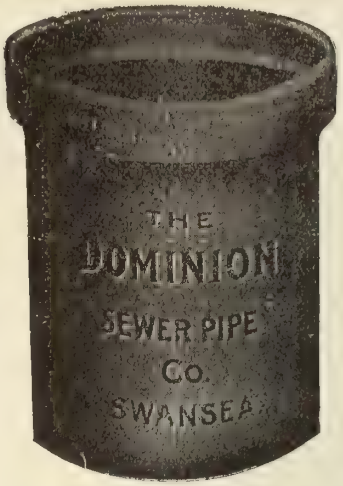

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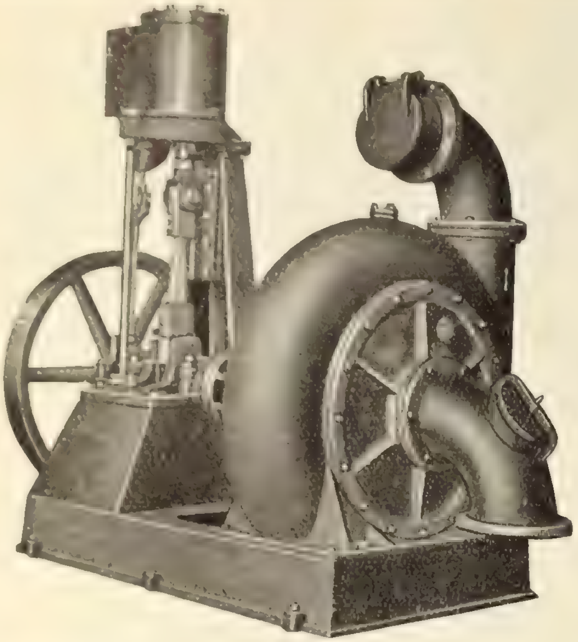

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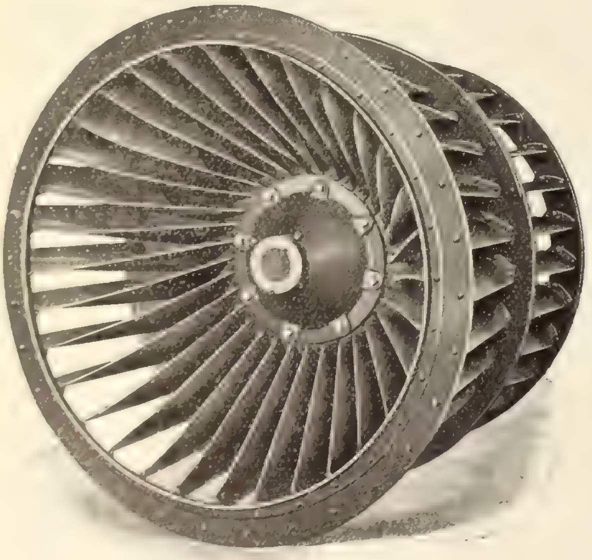

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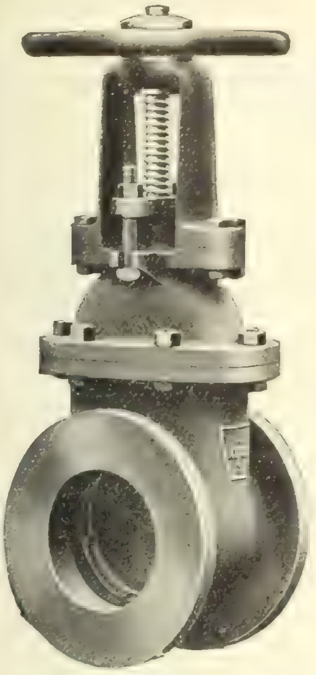

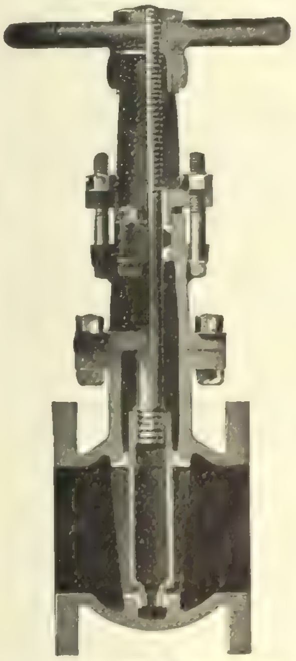

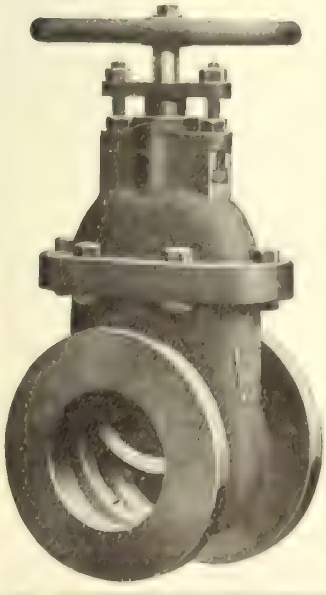

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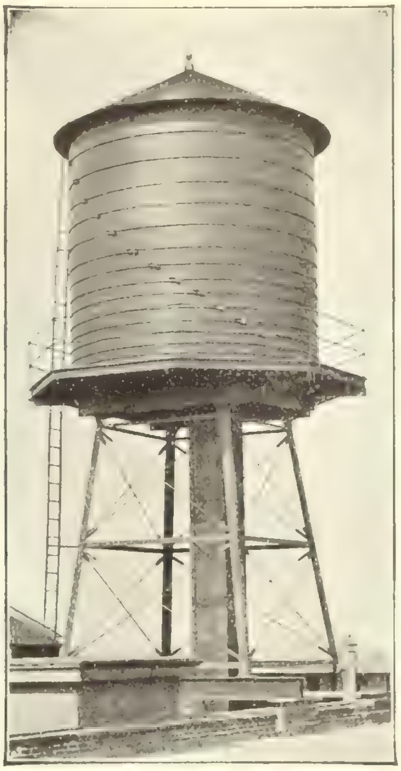

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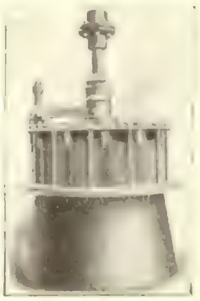

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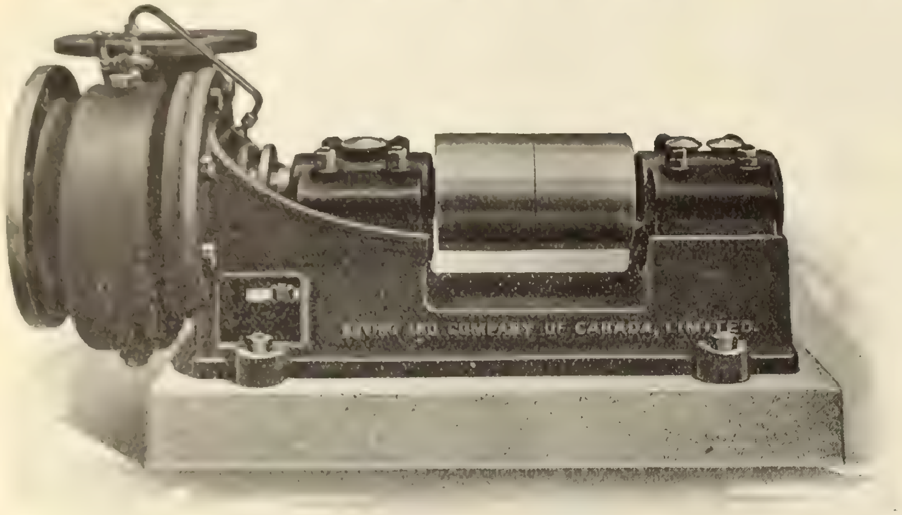

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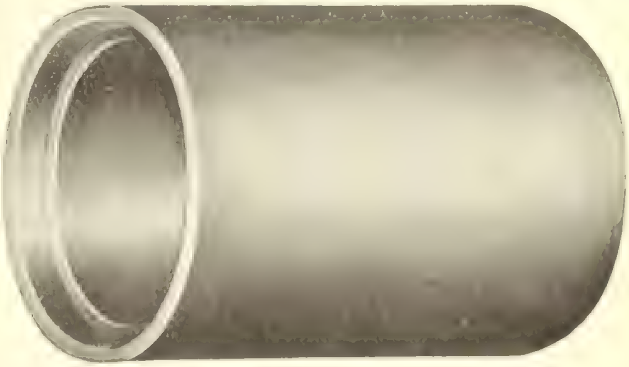

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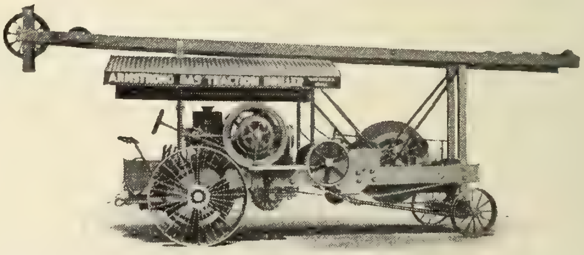

LOOK! at these two machines illustrated on this page. One is a Well Drill, the other a Special Blast Hole Drill. Little difference in the general design with the exception of the Spudding Beam; but note this difference carefully. That one feature determines the results you can expect from your tools in a drilling motion—is the one point that increases your efficiency from 50% to 100%, and is the reason why the **Armstrong Special Blast Hole Drill** will drill more blast holes, at less cost, and with less wear and tear than any other machine made

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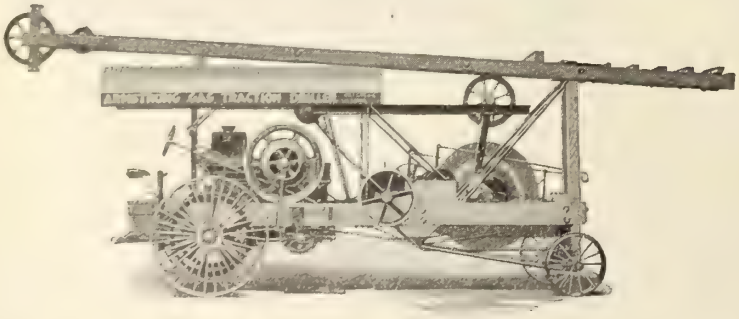
Armstrong Special Blast Hole Drill



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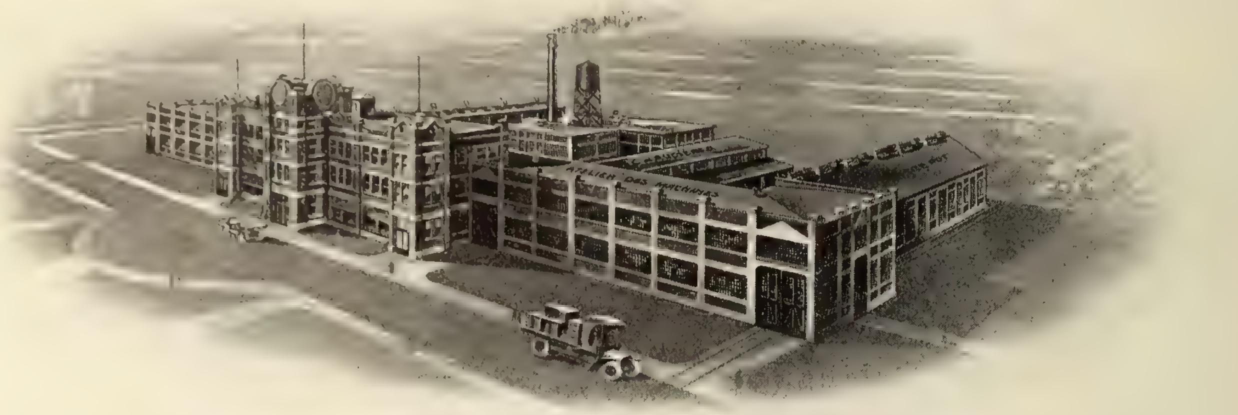

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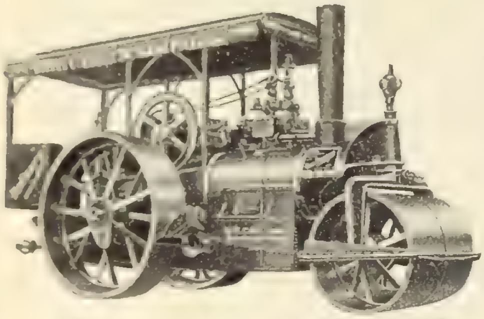

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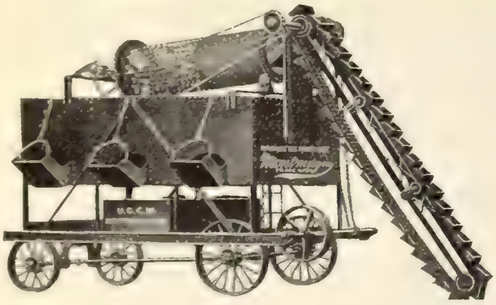

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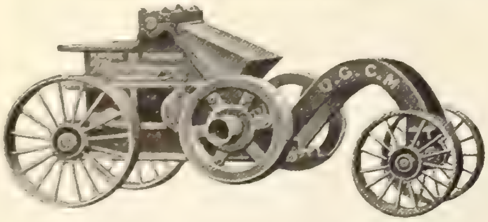

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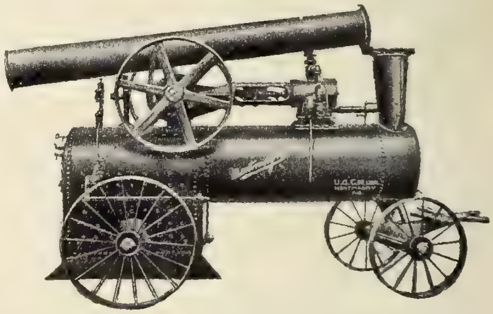

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Use the Zouri Setting for an Attractive Store Front

A good location helps—but the sales of every store are largely influenced by window displays. Window displays are not 100 per cent. effective unless everyone who passes is compelled to look. The store front attracts attention—the window display creates the desire to buy.

You can give all your stores a business-producing front, at a small cost, by the Zouri System. Don't give final instructions on any store building you are erecting until you know the **many** advantages of the

Zouri SAFETY & BURGLAR-PROOF SETTING FOR PLATE GLASS

OPERATING UNDER MURNANE AND MARR PATENTS

Windows installed according to the Zouri System can be used winter or summer. Perfect ventilation and drainage gives a clean, dustless window in summer—a frostless one in winter. Easily and quickly set in place. Locked with a key.

The Zouri System of securing indirect pressure on the glass eliminates most of the danger of breaking. A smooth unbroken surface, inside and out. No screw heads visible. All fastenings concealed. Built of solid copper—it gives service year in and year out without showing wear.

Give us the name of your prospects and we'll convince them of the many advantages of Zouri Setting. And we would like to send detail sheets and full particulars regarding the Zouri System to you, if you are unacquainted with its merits

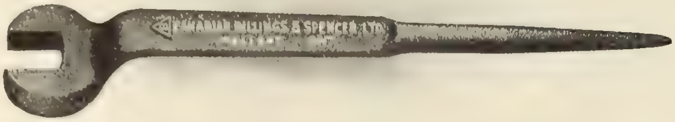
Zouri Drawn Metals Company

General Offices and Factory: 227-241 W. Schiller St., Chicago, Ill.

CANADIAN AGENTS: W. H. Clark, Ltd., Edmonton, Alta. Cushing Bros. Co., Calgary, Alta.
Saskatchewan Supply Co., Ltd., Saskatoon, Sask.

Canadian Billings & Spencer, Limited

B TRADE MARK



B TRADE MARK

Structural Wrenches—
Drop forged—Standard

Welland, Ontario

Burlington Steel Co.

Limited

Hamilton, Canada

Formerly Canada Steel Co., Limited

STEEL BARS

for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares

ANGLES—¾" x ¾" x 1/8 up to 2" x 2" x 5/16".
CHANNELS—¾", - 7/8", - 1", and 1¼".

T-Bars, Ovals, Half Ovals, Half Rounds, Bands. Cross Arm Braces

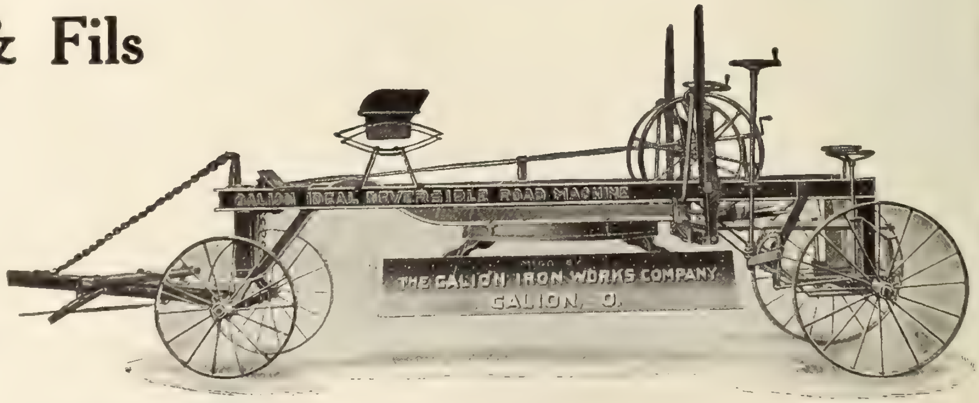
Plain and Galvanized

PROMPT SHIPMENTS

J. B. Dore & Fils

Road Graders, Rock Crushers, Portable Engines, Steam Road Rollers, Sprinklers etc.

362 Craig St. West, Montreal
and Laprarie, Que.


GALION IDEAL REVERSIBLE ROAD MACHINE
MADE BY
THE GALION IRON WORKS COMPANY
GALION, O.

Canadian Building Record

Facts and figures that mean much to you in determining how closely your sales approach what they should be in each of the nine Canadian Provinces.

	1910	1911	1912	1912
British Columbia	17,283,164	27,196,547	38.438,050	20,025,902
Alberta	10,221,435	18,798783	39,701,421	23,273,364
Saskatchewan	7,013,224	13.920,996	29,180,515	17,716,260
Manitoba	16,340,835	20,387,164	22,976,116	20,366,324
Ontario	36,372,172	46,242,357	59.205,346	54,967,921
Quebec	20,604,364	23,716,414	37,180,147	38,158,663
New Brunswick	719,990	1,444.095	961,815	2,412,000
Prince Edward Island	55,000	96,300	40,000	230,400
Nova Scotia	1,511,599	1,663,542	2,258.036	1,673,954
Total ... ...$	110.121,783	153,466,198	229,941,446	178,824,788

Millions of dollars' worth of materials will be purchased by builders and constructors in Canada this year. Nearly every one of them is a possible customer for you. Are you sharing in these opportunities to the fullest extent? Are you getting in on the ground floor in time to compete with your competitors?

As a keen business man you cannot afford to overlook the selling assistance of MacLean Reports. They are issued daily (card system) and give accurate and early information on CANADIAN building and engineering projects, contemplated, their progress, and details of the material and equipment required.

With MacLean Reports you can analyze your sales and see how closely they approach what they should be. You can pick the territory where increased effort can most profitably be exerted. You can deal with each province or city effectively and stimulate sales in localities you want to reach with least selling expense and with no lost effort.

With MacLean Reports you may analyze and anticipate the wants of your prospects—to be prepared not only to fill their wants but often to demonstrate that they exist. As the first man on the scene you will have a tremendous advantage over your competitors.

MacLean Reports put you in touch with the right job at the right time, the right man to see and the right place to find him. They are the only efficient and economical method of keeping pace with competition. Use this early, authentic information to your own profit.

Send today for rates and sample reports. Mention the provinces you wish covered.

MacLean Daily Reports, Limited

220 King St. West,
TORONTO, CAN.

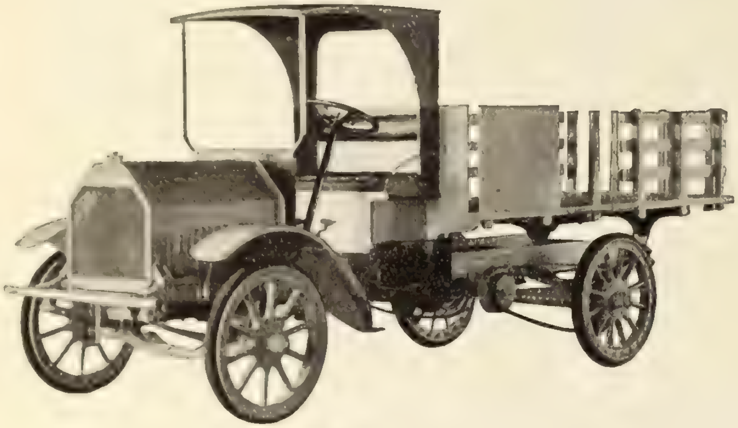
119 Board of Trade
MONTREAL, QUE.

Travellers' Bldg.
WINNIPEG, MAN.

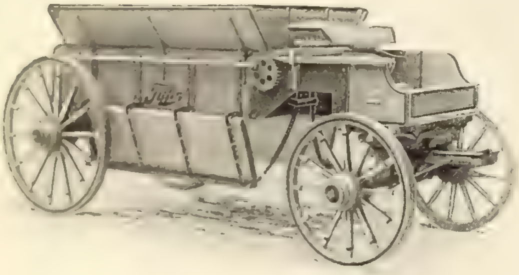
Hutchison Blk.,
VANCOUVER, B.C.

TIFFIN

MOTOR TRUCKS



Tiffin Motor Trucks.



Tiffin Dump Wagons.

TIFFIN SPRINKLER, STEEL TANK, VERTICAL SPRAYER

Street Flushing Machines
Street Sprinklers
Dump Wagons
Street Cleaning Carts
Municipal Vehicles of every kind

From the beginning our aim has been to excel in everything we make, to build our vehicles better if possible than any made of their kind: the reputation of our products today from coast to coast will tell how well we have succeeded.

Francis Hankin & Company, Agents, Montreal, Toronto and Vancouver

The Tiffin Wagon Co.
Tiffin, Ohio, U. S. A.

Roden Bros. Factory, Carlaw Ave., Toronto

Modern Mill Construction Factory, Large Windows, Metal Sash, Fire Proof Stair and Elevator Shafts, Fire Proof Vaults, Fire Proof Boiler Room.

Designed and built complete ready for occupation with no trouble or worry to the owners.

We are able to design and build any type of building suitable to your requirements.

Write us for Plans and Estimates

Wells & Gray, Limited

Engineers & Contractors

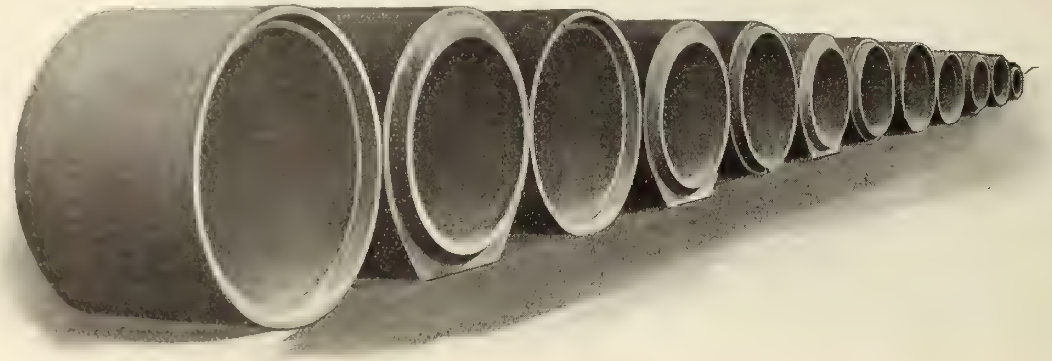
247 Confederation Life Bldg. TORONTO

Everything in Concrete and Cement

The most modern plant in Ontario, plus unsurpassed manufacturing facilities and the use of the best raw materials are the forces governing the output of our concrete products. Our manufactures include building blocks, silo blocks, concrete fence posts, railroad pipes, and culvert and sewer pipes.

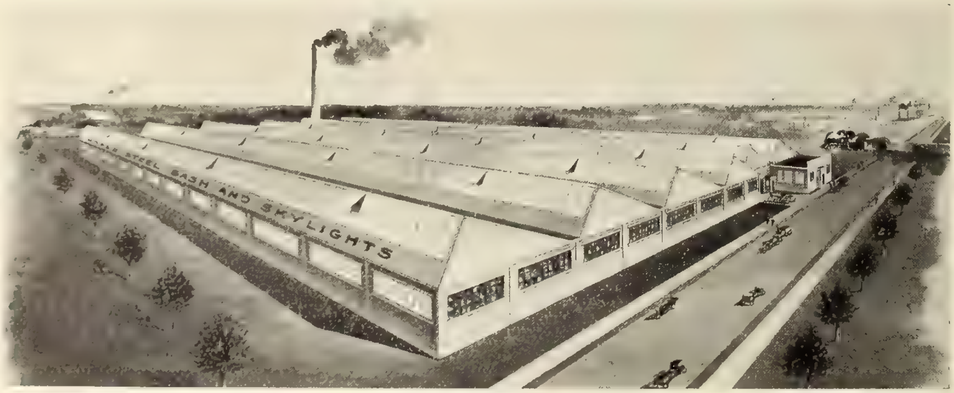
We make a point of supplying special ornamental trimmings for public buildings, churches and schools.

Your enquiries are respectfully solicited, and will receive prompt attention.



National Concrete Mfg. Company, Limited

LINDSAY, ONTARIO



THE HOPE CANADIAN FACTORY

HOPE STEEL SASH

A building equipped with Hope Steel Sash is an advertisement of enterprise and ability. The many special types of Hope Sash are each designed for a particular class of building. Because of the strong solid section, patented joint and adjustable double contact casement ventilators HOPE SASH offers many practical advantages that mean satisfaction to your client.

Write for Catalogue.

HENRY HOPE & SONS OF CANADA, LIMITED

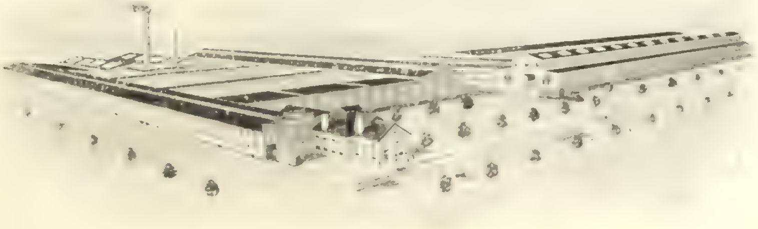
43-45 King Street West, TORONTO

AGENTS:— Peart Bros., Regina W. N. O'Neil & Co., Vancouver Aikenhead Clark Hardware Co., Winnipeg
Walker & Barnes, Edmonton Gandy & Allison, St. John, N. B. E. F. Stevens, Halifax David McGill, Montreal

For up-to-date Building Construction use

Pedlar's "Perfect" Expanded Metal Lath

Made in our own shops from the very highest grade of special unpickled sheel metal. Supplied painted or galvanized The best-known medium on the market for binding cement and plaster to flat surfaces, and used throughout Canada on the modern office and Government buildings.



Pedlar's Steel Corner Beads—Rigid and straight—Guarantee perfect alignment and an indestructible corner. Won't rust. Unaffected by any kind of plaster. Easily curved to any shape.

Lock and bind plaster and steel most effectively.

Pedlar's Metal Wall Ties make the most satisfactory ties for bonding walls, either solid or veneer.

Pedlar's "Perfect" Steel Wall Plug has superseded the old style wooden plug in all modern construction. Holds on "like a Bull-dog."

Our catalogue No. 22 C. R. gives full details of our many lines of Sheet Metal Products.
A copy is yours for the asking. Write to nearest address.

The Pedlar People, Limited
OSHAWA **Established 1861** **ONTARIO**
Toronto Ottawa Montreal Winnipeg London Chatham St. John Quebec Sydney Halifax Calgary Vancouver

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Use A Thew—It Pays

Type O Thew Shovel on Road Grading

"We are very sorry we did not buy the shovel long ago."

That's what the owner of this Type O Thew Shovel said after he had put the Shovel to work and saw the amount of money he might have saved had he only realized sooner that **The Thew Shovel really does handle shallow as well as deep cuts efficiently and economically.**

Here's what the contractor owning this shovel wrote us:—

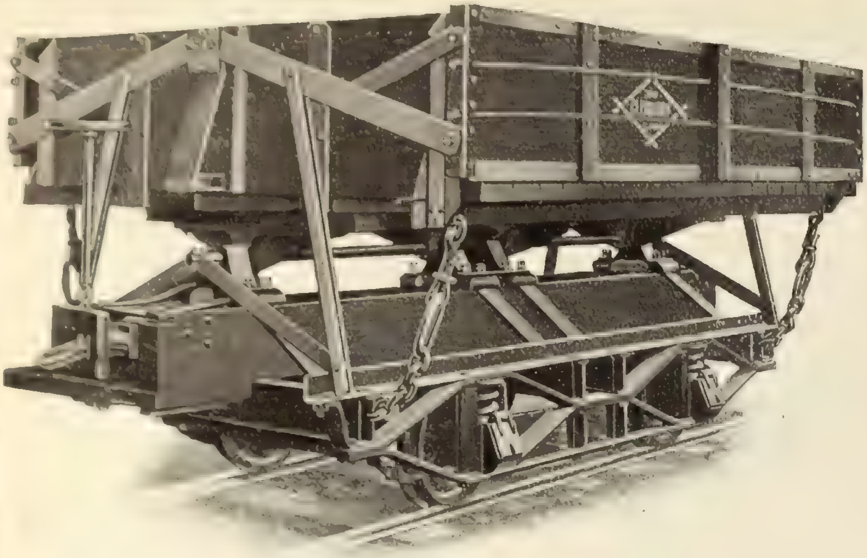
"The Shovel loaded 1,965 cu. yds. in seven days in a one to four foot cut, part of which was solid limestone. There is no mistake about the shovel being a time saver and a money maker and now that we know what the shovel is, we would not be without it and are very sorry we did not buy the shovel long ago."

Before you decide how you are going to handle your excavating, let us refer you to some contractor near you who has used a **Thew** on the same class of **Work.**

There are over **1,000 Thews** in service. Some of them are near you. Investigate the results being secured with the nearest Thew and be convinced.

WRITE FOR CATALOGUE AND LEARN
WHY THE THEW IS BEST

The Thew Automatic Shovel Company, - Lorain, Ohio



Cut showing 4 and 6 yard Double Diamond Steel Frame Side Dump Car. The best yet.

We introduce to the contracting trade our new steel frame cars. We assure you here is value for your money. Nothing hasty about the design, but a careful sifting of really desirable features required. We ask that you write us for specifications and full particulars. Better value never offered.

GLENGARRY

Something New in Steel Frame Cars

Here is our new double diamond steel frame car. Has more advanced improvements than all competitors.

FEATURES

Shorter diamonds; stiffer frame; angle over diamonds; perfect trussing of frame and drawbars; removable box carried on heavy rod full length—no pins. Stronger and stiffer box having wonderful underframe support. Doors reversible, steel bound, double trussed. Perfect door action. Strong simple irons. In short, has the best points claimed by competitors, with many improvements added.

Watch next week's issue.

The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

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YOUR PROTECTION

IS

The Bay Stater

When ordering a Coating for the protection or Decoration of Concrete, Cement, Brick and Stucco purchase

BAY STATE

and see that every container bears our trade mark.

We are the **only** manufacturers of **Bay State** Brick and Cement Coating. Bear in mind that we made and introduced the first **successful** Brick and Cement Coating placed on the market.

Send for Booklet W.

Wadsworth, Howland & Co., Inc.

PAINT AND VARNISH MAKERS AND LEAD CORRODERS

82-84 Washington Street
BOSTON, MASS.

Canadian Representatives:—Walter F. Gouinlock, 217 Confederation Life Bldg., Toronto, Can.; David McGill, 83 Bleury St., Montreal, Can.; Waite-Fullerton Co., Winnipeg, Calgary, Edmonton and Regina.

KAHN SYSTEM

OF REINFORCED CONCRETE

Steel Sash
Hyrib
Rib Bars
Rib Metal

KAHN SYSTEM
Reinforced Concrete

Concrete Finishes
Water-proofing Pastes

STEEL FLORETYLE
FOR LONG SPAN CONSTRUCTION

Trussed Concrete Steel Co.
of Canada Limited
Head Offices and Works: Walkerville, Ont.
Branches Everywhere

WELLER-MADE

is a guarantee to
Service and Quality

Weller-Made does not merely represent so much "machinery"—it stands for unusual care in construction and high quality of materials. Weller Engineering Dept. is always ready to co-operate with you on all your Elevating, Conveying and Power Transmission problems. This means service, plus quality.

Our No. 20 catalogue fully describes and illustrates the complete line of Weller-Made Machinery.

Such as **Spiral Conveyors, Belt Conveyors, Car Pullers, Screens, Dump Cars, Power Shovels, Etc., Etc.**

Rope Drives, Shafting, Belting, Pillow Blocks, Pulleys, Bearings, Gears, Etc.

You should have a copy of this valuable catalogue before you. Sent free upon request.

Weller Mfg. Co., Chicago
New York Office;
50 Church St.

Take your pick—
or take them all

"Waterproofing for Cement Stucco Houses."

"Waterproofing Damp and Leaky Basements."

"Waterproofing on the Farm."

"Waterproofing with Ceresit. A Story of What a Contractor did in a Small Town."

"Waterproofing Black Hawk, the 40-foot Reinforced Concrete Indian."

CERESIT
TRADE MARK

A Cement Waterproofer That Always Gives Satisfaction

Hundreds of Contractors, Engineers, Architects, and others got their copies of these interesting and valuable waterproofing publications at the recent Chicago Cement Show.

Did You Get Yours?

If not, just drop us a line and we will send you the most interesting and valuable set of literature on waterproofing cement that you have ever seen.

Write to-day NOW before you forget.

Ceresit Waterproofing Co.
913 Westminster Building, Chicago

Factories—Chicago, Unna, Germany, London, Paris, Vienna, Warsaw

LIST OF DEALERS. W. B. Poucher, Edmonton, Alta.; F. G. Cullen, Vancouver, B.C.; Walker's, Ltd., Winnipeg, Man.; R. deB. Carritte, St. John, N.B.; W. R. Macdonald Co., Toronto, Ont.; The Whitlock-Riddell Co., Moose Jaw, Sask.; Brown & Chapman, Regina, Sask.; MacKenzie & Thayer, Ltd., Saskatoon, Sask.; N. C. DeHaas, Sault St. Marie, Ont.

H. Mueller Mfg. Co., Limited C. R.
Sarnia, Ont.

Gentlemen:

Send me tapping machine literature and prices.

Signed

City Province

As Others Tell It:

Mr. C. Ulses, Supt., has a Mueller Machine which has been in use 25 years.

Mr. Joe S. Rhodes, Supt., has a Mueller Machine which has been used 25 years and is PRACTICALLY AS GOOD AS NEW.

Mr. Nels G. Sandberg, Supt., has a Mueller Machine 17 years old, which he has operated himself the past 10 years. It is still giving EXCELLENT SERVICE.

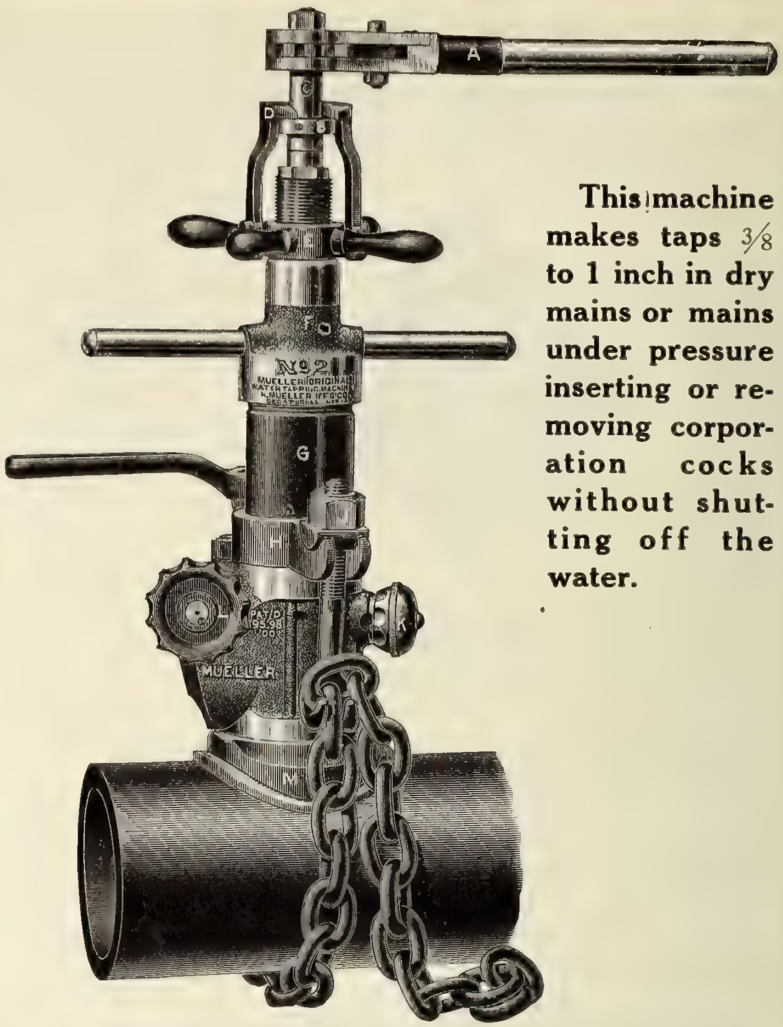
Mr. S. B. Severim, Manager, says: "We have had a Mueller machine for 22 years and as yet it has not called for one cent of repairs. A machine that has given service for TWENTY-TWO YEARS WITHOUT REPAIRS, IS BEYOND QUESTION O. K."

M. W. E. Trull, Supt., used a Mueller Machine 26 years, making over ONE THOUSAND TAPS, and he adds, "So you see the machine does NOT OWE US ANYTHING."

Ask any of these or hundreds of others.

We will gladly give address.

THEY ALL TELL THE SAME STORY.



No. 2 Mueller

This machine makes taps 3/8 to 1 inch in dry mains or mains under pressure inserting or removing corporation cocks without shutting off the water.

Mueller Water Tapping Machine

You can do your work in less time, with less effort and at less cost than with any machine on the market.

And the Mueller Machine will last a life time if given fair treatment.

It is the most useful and valuable and at the same time the least expensive tool, about a Water Works plant.

You can see that it is not an experiment but a tool that HAS MADE GOOD through a long period of years.

For lighter work we make a No. 1 machine and for heavier work a No. 3, but the No. 2 is the Happy Medium;

It is Unconditionally Guaranteed. Clip and mail the coupon to-day.

Made in Canada

H. Mueller Mfg. Co., Limited

Sarnia, Ontario

AZTEC ASPHALT

Refined by U. S. Asphalt Refining Co., New York

TRADE MARK

TRADE MARK

Swetland Avenue, Scranton, Pa.

100° In the Shade or 40 Below

Tests in laboratory and tests in hard service on the road have proved **Aztec Asphalt** to be the best for Canadian Roadways. The extremes of heat and cold in Canada have no injurious effect on **Aztec**—it remains firm in Summer and does not become brittle in Winter even when buried under ice and snow for a long period.

Other asphalts that are entirely successful in South America, Mexico, Europe or in central or southern parts of the United States, might fail in Canada because of the extremes in temperature here.

For Canada asphalt must not only be pure (nearly 100 per cent. bitumen) but the bitumen must retain its tenacity at all temperatures. In this regard **Aztec** excels. It is impervious to water, has great coherence, resisting wave tendencies.

Aztec is refined by the U. S. Asphalt Refining Company, New York, from liquid asphalt, or maltha, imported from Vera Cruz (Mexico), the land of the Aztecs. It is the expert North American labor, added to the high character of the Mexican maltha, that accounts for **Aztec's** superior qualities.

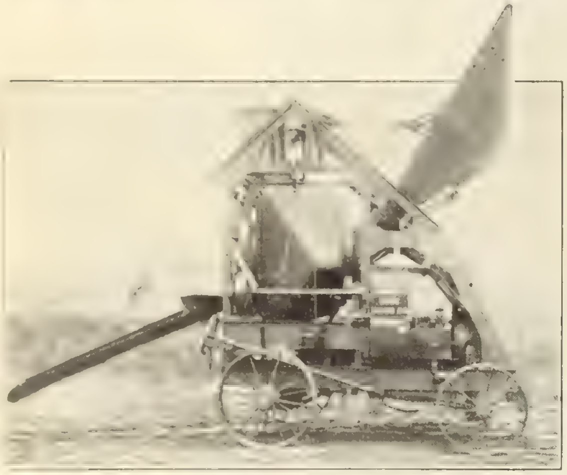
Canadian municipal and highway engineers and road contractors should buy **Aztec Asphalt** on account of the qualities possessed by its bitumen. It is not—like other asphalts—merely "over 99 per cent. bitumen." **Aztec** is over 99 per cent. bitumen of special qualities that make it particularly suitable for Canadian requirements.

Aztec Oil & Asphalt Refining Co., of Canada

137 McGill Street, Montreal

This New Austin Cube Mixer

For Street and Road Paving



is a one man machine and reduces concrete road construction to its simplest terms. You cannot make the maximum profit or compete successfully if your mixer is not of the right design to suit the job.

This new **Austin Cube** is built to do certain classes of street and road mixing more economically than the larger types—but remember the mixing principle is the same. It is the cube shaped drum that does the work and is the same as found in the **Austin Improved Cube Mixers** which were used for the principal part of the concrete mixing for the Miraflores, Gatun and Pedro Miguel Dams at Panama.

One man can operate it, mix and deliver 1000 square yards of 6 inch concrete per day.

The same gasoline engine which does the work will propel the machine forward or backward at about 2 miles per hour. The total weight of the machine is 11,000 lbs. The chute through which the concrete is distributed is 10 ft. long and this may be reduced to a length of 8 or 6 ft. without stopping the machine.

Ask our Canadian Representatives

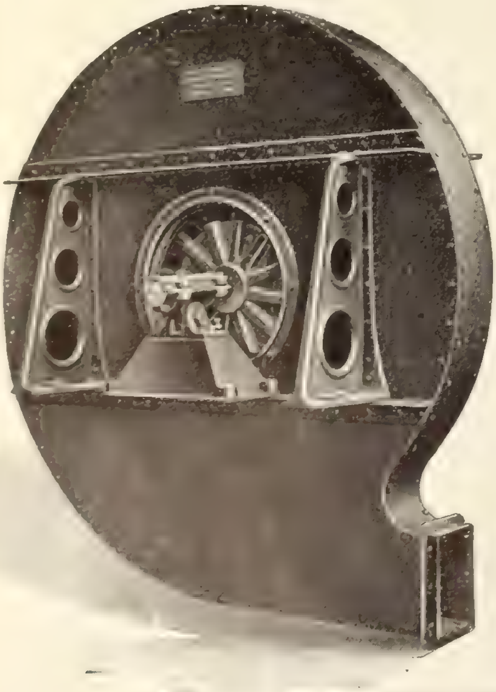
LECKY & COLLIS, Ltd., 335a Craig St. W., Montreal, P. Q. 43 Scott St., Toronto, Ontario. P. O. Box 11, Napanee, Ont.
CANADIAN EQUIPMENT & SUPPLY CO., Calgary E. G. CULLEN, Vancouver

Municipal Engineering & Contracting Co.

Eastern Office: 90 West Street, New York City Main Office: Railway Exchange Bldg., Chicago, U. S. A.

Your Cupola — Are You Giving it a Fair Chance?

Is it assisted by a Blower that provides for perfect combustion of the fuel?
Does it produce sufficient pressure to overcome the resistance within the cupola?



"Sirocco" TRADE MARK. Special Steel Pressure Blowers

do these all-important things and at a lower cost for power than blowers of other types or even of the same type.
There are no frictional surfaces to "eat up" power in a "Sirocco" Blower. The bearings are self-aligning and self-oiling. Being independent of the housing prevents vibration.
The speeds of "Sirocco" Blowers are adaptable to direct connection to electric motors and steam turbines, thereby eliminating the usual belt and gear power losses.
Every ounce of energy put into a "Sirrocco" Special Steel Pressure Blower goes to **propelling air.**

Write for Bulletin No. 8. It contains helpful information on Pressure Blowers

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR, ONTARIO.

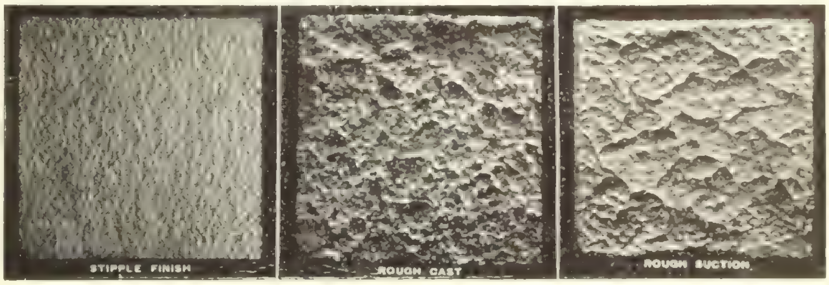
—Sales Engineers—

C. T. MORSE 301 McGill Bldg., Montreal	E. C. POWERS 45 Victoria Street, Toronto	W. P. EDDY 214 Donald Street, Winnipeg	S. S. CLARKE 605 2nd Street, Calgary

A Few of the Handsome Finishes Possible with

J-M Asbestos Stucco

J-M Asbestos Stucco, is susceptible to a greater variety of finishes in the surface treatment than any other stucco. And it is far more handsome and durable than cement and sand stuccos.



This stucco dries an attractive uniform color which lasts indefinitely because it contains no sand to cause it to become mottled, stained and discolored. Instead of sand, pure pulverized asbestos rock and asbestos fibres are used.

J-M Asbestos Stucco also provides a real protection to a building. It is the most weatherproof and fireproof stucco on the market and is a non-conductor of heat and cold. As it is lighter in weight and spreads more evenly and smoothly than ordinary sand and cement stuccos, it can be applied at a lower labor cost. In prepared form, it can be furnished in white and various shades of gray and buff.

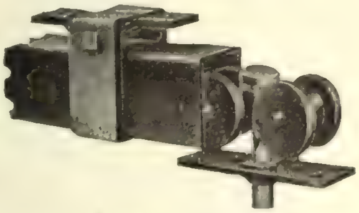
Write our Nearest House for Booklet

The CANADIAN H. W. JOHNS-MANVILLE CO., Limited

Manufacturers of Asbestos Roofings; Stucco; Pipe Coverings; Cold Storage Insulation; Waterproofing; Sanitary Specialties; Acoustical Correction; Cork Tiling; Fireproof Doors, Etc.

TORONTO MONTREAL ASBESTOS WINNIPEG VANCOUVER

"A Hanger for any Door that Slides"



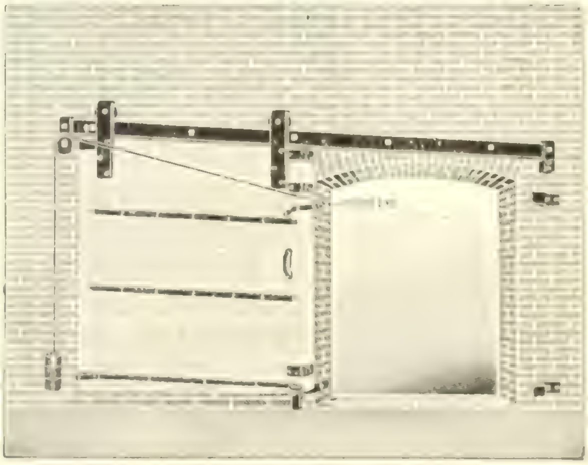
Folding Door Hanger.
Forged Steel Ball Bearing.

Trolley Hanger 150½ B.
Forged Steel Ball Bearing
Vertical and Lateral
Adjustment.

There is a right hanger for every purpose, in the Richards - Wilcox line, and conscientious builders always want the "one right thing."

Our catalogue (mailed on request) enables you to select this one right hanger and to avoid the common mistake of hanging doors on hardware that is too light or not adapted to the purpose.

We recommend the trolley hanger for all purposes except fire doors. Consult us about any special equipment you may need.

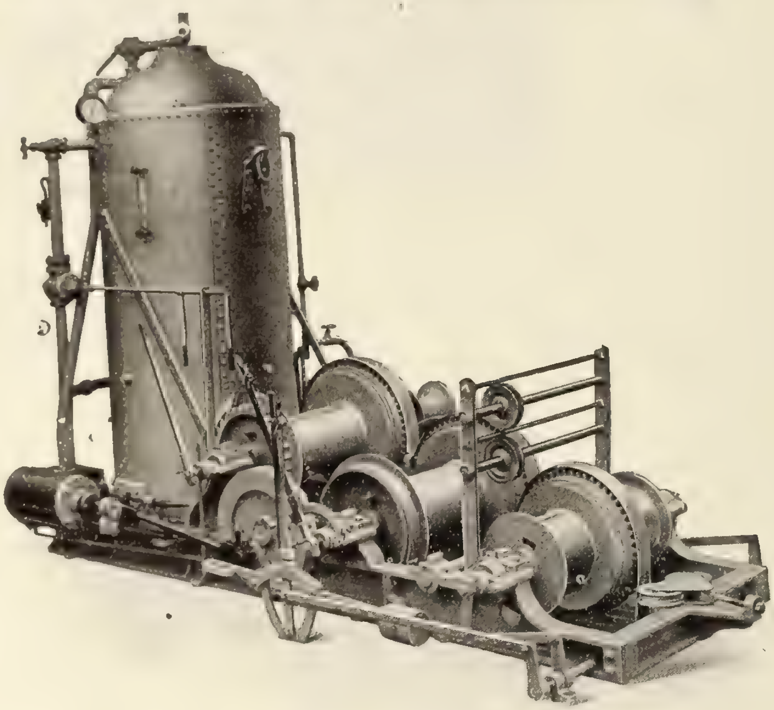


UNDERWRITERS INSPECTED HARDWARE LABORATORIES

FIRE DOOR HARDWARE Swing, Slide and Vertical [illegible] Inspected under the [illegible] of Underwriters' Laboratories [illegible]

Richards-Wilcox
CANADIAN COMPANY, LTD
LONDON, ONTARIO.

BEATTY HOISTS and Material Handling Plant



TANDARD DOUBLE CYLINDER, DOUBLE FRICTION DRUM HOIST WITH NO. 2 SWINGER.

The satisfactory performance of Beatty Hoists and Clamshells has been demonstrated on thousands of jobs throughout the Dominion.

If you require a Single, Double or Triple Drum Hoist of any size, let us show you what we can do in the way of construction, delivery and price.

We can meet your requirements on all three counts.

Standard size Hoists, Clamshells, Derrick Irons, etc. ready for immediate shipment.

Let us send you our new general catalog.

TYPE "D" DREDGING CLAM.

M. BEATTY & SONS, LIMITED

WELLAND, ONTARIO

—AGENTS:—

H. E. Plant, 1790 St. James St., Montreal
Robt. Hamilton & Co., Vancouver, B. C.
H. W. Petrie, Limited, Toronto.
E. Leonard & Sons, St. John, N. B.
A. R. Williams Machinery Co., Winnipeg

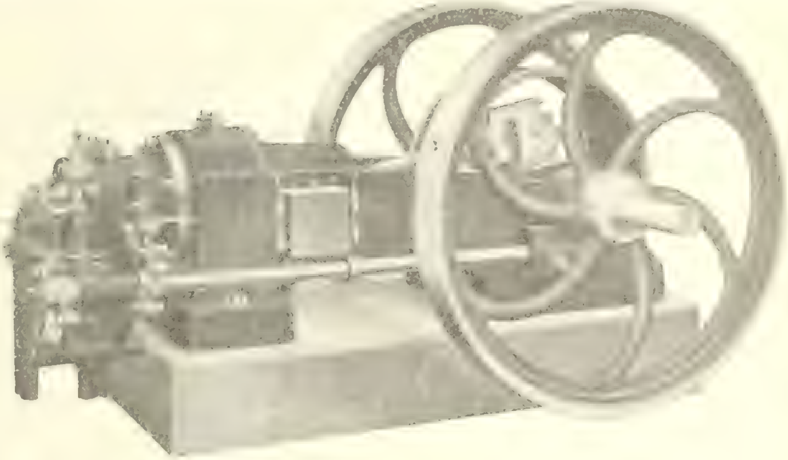
NATIONAL GAS ENGINES

Sole Canadian Agents for National Gas Engines [illegible]
Daniel Adamson & Co., steam turbines, rotary blowers and compressors, sewage equipment.
Adams & Co., Boa cleaning works.
Geo. Shipman & Co., high-speed steel.
Rochdale Asbestos Co , Rochdale, England, asbestos packing and manufacturers.

FOR
SUCTION
PRESSURE
TOWN
NATURAL
COKE OVEN and
BLAST FURNACE
GASES

Horizontal Type from ¾ H.P. to 450 H.P.

Vertical Type from 350 H.P. to 1,500 H.P. and up.



Write for Catalogue

BRITISH MANUFACTURERS

ASSOCIATION OF CANADA, LIMITED
803 McGill Building, Montreal

No. 232

Toch Bros. "R.I.W." **Estab. 1848**

REMEMBER IT'S WATERPROOF

DAMP RESISTING PAINT

MANUFACTURED IN CANADA

INSULATES
CHECKS DAMPNESS
BONDS PLASTER TO BRICKWORK
SAVES COST OF FURRING

Write for
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Published Each Wednesday By
HUGH C. MacLEAN, LIMITED
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
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CHICAGO - Tel. Randolph 6018 - 659 Peoples Gas Bldg.
LONDON, ENG. - - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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Facts and Figures About Building

BUILDING prospects for the present year are exceedingly bright in most parts of the country. February is scarcely a month in which to look for much actual construction work, or even building projects, and the February of 1914 proved no exception to the rule. From the list of building permits issued for February and also for the two months of the present year we find that of the total of forty-one cities from which records have been received, a decrease to the extent of $4,800,478 is recorded for the two months, and a decrease of $1,825,543 for the month of February, the total value of permits issued during the latter month being $3,923,393, as against $5,748,938 for the same period in the previous year. The record for the two months this year is $6,829,211, which represents a large reduction on the figures for the same period in 1913, the latter being $11,629,669. Decreases are also recorded in returns from twenty-four eastern cities. The amount for February, 1914, was $2,525,587, as against $3,217,177 in the corresponding period of last year, being a reduction of $691,590. The record for the two months of the present year is $4,401,695, as compared with $6,087,526, decrease $1,685,831. Records of the seventeen western cities show a decrease of $1,133,953 for February and a decrease of $3,114,627 for the two months period, the comparative figures being $1,397,806 for February of the present year, against $2,531,759 in the corresponding period in 1913. The figures for the two months period are $2,427,516 for 1914, as against $5,542,143 in the corresponding two months last year. Most of the larger cities, both in the east and in the west, record a falling off from last year's figures. This, however, need not be taken as a criterion, for though permits were lower there is every indication that a great deal of construction work will shortly be undertaken. Present indications point to the fact that building will be more or less confined to the smaller type of house in order to meet the great demand for accommodation. In Montreal the total value of permits for the two months of this year shows a reduction of $200,597 on last year's total for the corresponding period. In view of the number of building plans that were passed during the last two months of 1913 it is scarcely surprising that a falling off in the value of permits had to be recorded during the first weeks of this year. The city of Maisonneuve, however, shows a substantial advance during February.

Regarding Toronto, the majority of the 155 buildings for which plans were endorsed during February, were small brick dwellings ranging in value from $1,500 to $3,000. Among the larger permits the most important were a brick warehouse to be erected at the corner of Richmond and Duncan Streets at a cost of $75,000, a $60,000 lodging house on Sherbourne near Carlton, and a factory on Hayter Street. March permits to date include a large factory on Adelaide Street West at a cost of $40,000, and a brick block at the corner of Marley Avenue. Like most of the other cities, Toronto reports a reduction in the number of permits issued the first two months of the present year as compared with the corresponding period in the previous year. The decrease for February was $395,995 and for the two months $776,684.

Building prospects at St. John, N.B., appear to be very good though there was a decrease of [illegible] over the first two months of 1913 and a decrease of $88,300 in the returns for February, 1914, as compared with the previous year. As has already been announced in our columns, construction work on the sugar refinery and the new Post Office will be resumed, and the great harbor works at east and west St. John will be proceeded with as soon as the weather permits. It is doubtful whether work will be commenced this year upon the two new wharves, to be built by the Government at an estimated cost approaching a million dollars. Apart from this, however, there will be a much larger expenditure on harbor works this year at St. John, than in any previous year. Builders in London, Ont., are looking forward to a very busy season, the value of permits issued in the last-named city almost doubling those issued in the same period of 1913. If permits continue to show an equal growth the present year will probably surpass all records. The total value of permits issued for the two months of 1914 were $73,270, against 36,855, being an increase of $36,415. Higher building figures for February are recorded in several localities, Hamilton permits, valued at $163,100; St. Catharines, $38,450, and Windsor, $55,825, being the most prominent. In the western provinces so far as the records show the amount of constructional work in contemplation is below what it was twelve months ago, with the exception, perhaps, of the cities of Winnipeg and Medicine Hat.

Regarding Winnipeg, the prospects for the present year are exceedingly bright. To the end of February permits totalled $259,600 more than for the corresponding period last year. There appears every indication that this pace will be maintained during the year. Plans are being prepared by one architect for 10 apartment blocks, each to cost not less than $50,000 and a number of these buildings are certain to be commenced this year. In Medicine Hat the record shows an increase of $8,925 over the month of February, 1913, though a decrease of $7,105 is recorded for the first two months as against the corresponding date last year. One of the leading firms has announced an extensive building programme in view for the coming season.

At Vancouver, 239 permits have been issued for January and February, representing $473,593 in value, the total for the month of February being 127 permits valued at $262,076, as against $1,045,204 in February, 1913. The record, generally speaking, shows a decrease in 23 cities and an increase in 15 cities. The average decline during February in Eastern Canada was 21.4 per cent., in the West 44.3 per cent., and in 41 cities 31.7 per cent.

Why are Architects Estimates Always Low?

ONE of the striking differences between theory and practice is brought out in the matter of preliminary estimates furnished by architects on the plans they make. Perhaps it is not always the case that they under-estimate their plans, but it happens so many times that it has become a by-word among builders, and no contractor would agree to put up a building on the architect's estimate without figuring it for himself or taking some other builder's figures for it.

It may be that one of the reasons is really an unconscious one, and arises from a wish to make a desirable thing look reasonable in price to the prospective builder. If the architect goes too high, the party may not build at all, or he may try elsewhere for a more economical plan, so the preliminary estimate is based as nearly as possible on the prices of material available to the architect, and perhaps the price of labor on some similar building already erected. The estimator may not intentionally go lower than he thinks the work should be done, but he forgets that what really interests the owner is the price for which he can contract the job complete.

Sometimes architects ask for preliminary estimates from their friends in the various branches of contracting or manufacture, but very few concerns are willing to make up these estimates just as a favor to the architect, and he is really thrown upon his own resources for his costs, as he should be. However, an architect (and every architect who furnishes preliminary estimates) should get into closer touch with the methods of figuring practiced by general contractors. He should take notice of the several things given a money value by the contractor and which the architect is prone to ignore altogether.

The general contractor must figure his office work, whether he maintains a down-town office or whether he does the work himself at his own home; he is at some expense for superintendence, besides the cost of a working foreman; he must spend sums for railroad fare and car fare; he is at expense for correspondence, telephone and telegraph; he must pay freight and drayage; he must make good the mistakes of his own men, and also those of the sub-contractors, if they are not in a position to be held responsible for their work. Of course, he should not buy of such concerns, but some good people get into trouble after they make contracts, and before they are completed their responsibility has to be assumed by the general contractor.

Another thing which the architect often loses sight of is the amount general contractors figure as a profit or margin for doing business. If one figures the cost of a job by adding up the items with prices at the various sources of supply, he is bound to be short, and away short. For instance, an item just lately brought to mind was that of a clock system bought for a large high school building. Of course, the architect was able to tell the school board what the system required would cost, as he had the price from the manufacturer. It would be installed by some local plumber, as there were sundry pipes, wires and conduits to put in place. The plumber's bill, when the work was installed, was $1,200, and this was an item which did not enter into the estimate for the cost of the clock system. If this had been included in the work of the general contractor, he would have found out beforehand about the price of putting it in, and the discrepancy between the architect's estimate and the contractor's bid would have been that much greater.

There are two evils to the building business resulting from low preliminary estimates, and while they are not worthy the consideration of men who make a business of building, still the very fact that they arise unconsciously in the minds of the prospective builders makes them important to all parties concerned. The evils referred to are, first, the idea that the contractors are trying to get exorbitant prices for the work required, and, second, that the architect has purposely made the estimate low, so that the builder would go ahead and make his arrangements for building. Both of these ideas are unfortunate because they are both untrue and because they both might be prevented. The same thing holds in regard to the subcontracts, if the architect gives the patron a figure on them separately.

How much better would the feeling be if the estimates furnished by the architect would a little more than cover the completed buildings they design. It would often mean relief from real financial embarassment for the builder who makes his arrangements for capital before he lets his contracts. It would put the face of goodwill and honesty upon all parties interested, and that is where it should be in all legitimate business.

It must be borne in mind that it is no mean job for an architect to make up a reliable preliminary estimate without the aid of the men who do the work of sub-contracting. Very few general contractors figure the sub-contract work themselves, but get the bids of the various sub-contractors first hand, and from them and such other expense as will occur make up their bids on the whole building. The easiest way to arrive at something like a reliable figure is for the architect to compile a reference list of buildings and their actual cost for completion, and if he is diligent enough in this, he can, in time, match up the cost on just about anything he is liable to turn out himself

There are some men who make a business of making preliminary estimates, but few architects like to go to this extra expense when the building itself is more or less problematical. If they could show the prospective builder the picture of a building, a sketch of its floor plans and verbal description of its interior, with a statement of what it would cost complete, he would convey a better idea and at the same time relieve himself of a great deal of annoying and unprofitable work.

After the plans are approved and out for bids, then all the sub-contractors who are going to figure them get busy and do their several parts of figuring and turn the figures in to the general contractors who intend to bid on the work. If the architect could get these figures he would be in clover, but if he should get them on a preliminary estimate, the owner might conclude that he must cut it down $10,000 and that would cause the whole thing to be figured over again. Every concern in the building material business knows that it costs good money to make estimates, and unless it will give them some kind of advantage or preference they will not figure until the work is ready for the bids of the general contractors.

As a preliminary to foundation work in a new hydro-electric scheme near Augusta, Me., test holes were drilled to determine the character of the granite ledge on which the dam was to be built. To determine the extent of seams in the rock dye was forced in under pressure, the colour showing wherever there was a flaw in the stone. This method proved very satisfactory in that the character of the ledge was known in advance, and this prevented unnecessary drilling and excavation. The tests disclosed the presence of several dangerous, smooth, horizontal seams, to which it was necessary to excavate the ledge in order to prevent possible uplift and sliding of the dam. These test holes, as well as any other holes where necessary, were grouted under 100 lb. air pressure before construction commenced. In addition, to prevent possible sliding, trenches were cut in the ledge. It is believed that by these methods a very secure foundation was obtained at a minimum cost.

Contractors and Conservation

Contributed by R. O. Sweezey, C. E., Montreal

VIRTUALLY unknown a few years ago, the alluring word "conservation," which in this country conjures up pictures of vast forests, water powers and other great resources of nature, has now become synonymous with progressive national development.

The vigorous campaign of enlightenment instituted a comparatively short time ago with a view to educating and arousing the public to a realization of its duties towards posterity has so successfully gripped the minds of intelligent people that everywhere CONSERVATION is the keynote to the administration of natural resources.

Well does the writer recall many scenes of forests, which had taken over a century to grow, destroyed in a few hours—the result of gross negligence and profligacy of those who, on duty or pleasure bent, would travel through the wilds of the country with never a thought to extinguish a camp fire, leaving, in consequence, devastation and black desolation in their wake. Nor until recently were the railroads less to blame for similar destruction. Therefore it is gratifying to observe the wholesome effect of an awakened intelligence in those whose business or pleasure takes them into the wilds. Nowadays, in travelling by canoe and trail through Canada's hinterland, everywhere—with but one general exception—there are evidences of caution in the selection of camp grounds and fire places by the tourist or bushwhacker, while there is also manifest further care in extinguishing fire before breaking camp, so that abandoned and smouldering fires, testifying to the proximity of the tenderfoot, are now indeed rare sights.

The one general exception to the evidences of responsible care with fire in the woods is found wherever railroad construction camps have penetrated into the forests. Carelessness with fire, resulting in wanton destruction of the most exasperating nature, seems everywhere to attend the operations of railroad contractors in Canada's backwoods. This horrible menace lurking in the best forests of the land, in spite of all that has been said and done to emphasize the gravity of bush fires, is more real, and more calamitous in effect, than all the other enemies of the forest combined.

Employing, perforce, the most ignorant and indolent types of foreigner laborers, who are often under the command of a burly, wooden-headed type of foreman, it is not surprising that railroad contractors have become such dangerous enemies of the forest. These laborers, many of them recruited from the lowest ranks of ignorance, think nothing of setting fire, in a dry period, to the inflammable bark of a giant birch, merely to witness the effect. Fires for lunching purposes, for smudging flies, or for idle "cussedness," are never extinguished by such dough-heads but are left for a chance breeze to flame them into miles of burning timber. Nor, as a rule, do they exhibit any concern when disaster attends such criminal actions, remaining more often in blissful ignorance of the fact that it was their carelessness which caused the disaster. As for the construction bosses and foremen, they will concern themselves actively enough to save if possible their camp outfit and supplies, but they remain as a rule totally insensible to their duty in preventing the recurrence of such irreparable losses.

Is it any wonder that Dr. Fernow, after his rapid examination, a couple of years ago, of the forests along the line of the Transcontinental Railway in Northern Ontario, presented a report full of pessimism regarding the quantity of timber there? How could he report otherwise when the builders of the railway had been busily destroying the timber for several years?

Therefore it is among railway contractors and the class of laboring men they employ that the educative force of conservationists should be directed.

The offences of the railway contractors date back to the days of C. P. R. construction when they destroyed thousands of square miles of virgin timber north of the Great Lakes. These contractors must come to a realization of their responsibilities and abandon such reckless methods. As laws are now enacted aiming to make railroads responsible for forest protection so should measures no less stringent be enforced against the contractors, who—though they would deny it—as a class are negligent and dangerous to an alarming extent as regards bush fires. Several years of experience in the hinterlands of New Brunswick, Quebec, Ontario and Western Canada have furnished the writer innumerable proofs of these conditions. And now we must awaken to the fact that this menace is not past history but is every year being transformed into real and disastrous losses.

The Spring is now upon us and conditions will soon be ripe for a recurrence of the disasters which I have illustrated.

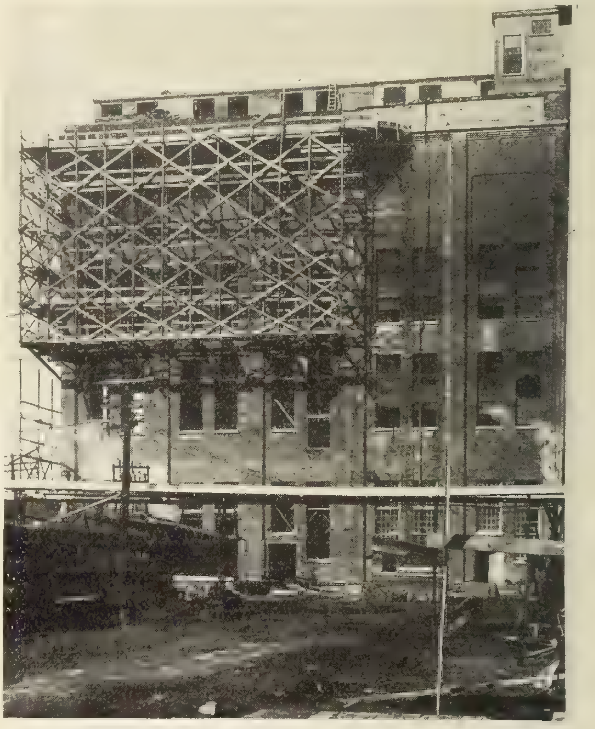
The comparatively rugged region of the St. Maurice River, with the thin sandy soil which overlies its Archean formation, provides conditions eminently favorable to disastrous results in case of bush fires. A very large area around the head waters of the St. Maurice, which was burnt over many years ago, is now but little reforested, presenting hundreds of square miles of desolation. This burnt area comprises the greater portion of the watershed above the point where the large storage dam is shortly to be built by the government of Quebec, at a cost of over one and a half millions of dollars. A word of caution might not be out of place here, for as the idea of this proposed storage is itself a child of conservation, in the carrying out of which 500,000 horse-power will be added to the falls of the St. Maurice, it is permissible to say something of the country which lies between the proposed dam site, some ten miles below the old H. B. Company's Post of Kikendatch and the Transcontinental railway.

To fetch in the materials and supplies for the building of this dam either a railroad or a team road will be built during the coming summer through a distance of 45 miles from the T. C. R. to the dam site. This road will traverse a fairly well-wooded portion of country, but unless prompt and proper measures are taken for fire protection it will be safe wagering that it will be a sorry looking country by the time that the road is completed.

CONSERVATION! May we never let up the cry until every man, woman and child from the Atlantic to the Pacific shall have grasped the full significance of it! And then, lest we forget it, may we keep on repeating it!

An Expeditious Contract at Hawkesbury

BELOW we illustrate a contract carried out by A. F. Byers & Company, Limited, Montreal, at Hawkesbury, Ont., for the Riordon Pulp and Paper Company. The latter concern have a sulphite fibre plant at Hawkesbury, and the contract was for the construction of an addition to their digester and blow pit buildings. The work was divided into two parts—the digester building and the blow pits, these being separated by the blow pit chamber. The digester structure was 32 ft. x 62 ft., and was four floors high, the top one containing the chip bins. It was built of structural steel, with brick walls, a pure cement mortar being used. The bricks were laid in English bond throughout, grouted every fourth course. The vomit pipes, for carrying off gases from the blow pits, were bolted to the outside walls of the digester building and were constructed of pitch pine.



Building for digesters, Riordon Pulp and Paper Company's plant, Hawkesbury, Ont.

The pits were 50 ft. x 60 ft. and 21 ft. high; they were three in number, each 17 ft. 2 in. wide, and lined throughout with pitch pine, which was held in place by wooden dowels, no nails being used in any of the wood work throughout the building. The pits were constructed of heavily reinforced concrete, with a structure of steel columns and angle tie rods.

The work was done by means of a Beatty hoisting engine and Smith mixer, the concrete being hoisted on the same elevator as the bricks.

The contract price was $50,000. The scaffolding cost $531 or a dollar and sixty cents per 1000 bricks used.

The time allowed for the work was 90 days, and the firm completed it according to contract.

Mexico, which can boast of some wonderfully fine churches, also claims the smallest church in the world. It is situated at Penon, near the city of Mexico, and has a "seating capacity" of about ten, although there are no seats.

Methods Employed in Strengthening an Old Factory Building

An Interesting Engineering Problem the Solution of Which was Found to be the Construction of Eight Monolithic Reinforced Concrete Flying Buttresses Built from Bed Rock to Roof

PILLSBURY "A" Mill, in Minneapolis, Minn., has recently been repaired to such an extent that it has been entirely rebuilt, with the exception of the walls. These latter, however, have been so strengthened as to be more solid than ever, and this, too, without stopping the mill or materially reducing its output. The wooden posts and girders were so weakened by dry rot and the walls so badly shaken by the vibration of heavy machinery, that they were badly cracked and about twenty-two inches out of plumb.

About twelve years ago Mr. J. H. Miller became alarmed at the condition of the wooden posts and girders and on his recommendation a series of four posts lengthwise and crosswise were erected through the centre of the mill. They were made up from I-beams and channels in the machine shop of the mill and erected by mill employees, the conditions not permitting any uniformity of length or even of design. No outside structural firm could do the work as advantageously as the mill company itself. As there was some criticism of this work, Mr. C. A. P. Turner was called in as engineer to examine it and report to the management. His only criticism was that the work which was complete up to the third floor at that time, was perhaps a little stronger than necessary.

At his suggestion, Bethlehem "H" sections were adopted for the remaining columns. He also advised the use of vertical diagonal braces to stay the mill laterally, but because of the room these would require and the shifting of machinery necessary to accommodate them, this advice was not heeded. The substitution of steel for wooden posts and girders was carried on until the company went into the hands of receivers for reorganization, and nothing was done for several years.

After the reorganization, Mr. Max Lehman was made superintendent of the mills and this work was again started. The vibration of the mill became alarming and both the north and south walls were badly cracked near the corners of the building; the floors seem to have acted as horizontal trusses and to have transmitted the stress to the end walls. Several diagonal braces of 12 in. x 12 in. timber were put in as a temporary expedient, and in January, 1913, Mr. Turner was called upon to devise something to take the place of the diagonal bracing which he had proposed. Having ascertained that the eastward sag of the building was not due to any settlement of the foundation he concluded that if the east wall was firmly held in position, steel struts could be run from wall to wall between the joists of each floor to hold the west wall from falling in, this wall having nothing to carry but its own weight and one end of the joists of the west panels. Mr. Turner recommended that monolithic reinforced buttresses be built outside the east wall and that the replacement of wood with steel be extended to include the whole interior construction. This being approved by Mr. Wm. DeLabarre, engineer for the Minneapolis Mill Company representing the Water Power interests of the Pillsbury Flour Mills Company, the scheme was adopted and carried out. The interior steel work was done by mill employees under the direction of Mr. Wm. Quayle, head millwright, and the concrete work both outside and inside by Messrs. H. N. Leighton & Company, contractors, Mr. F. A. Camp superintending it as an assistant to Mr. C. A. P. Turner.

The building is about 170 ft. x 108 ft., six storeys and basement in the main part with a cupola about 48 ft. x 108 ft. above the main roof, constituting a seventh floor. The total height from basement floor to cupola roof is 127 ft. 6 in. There are 60 columns arranged in six rows of ten each dividing the floor space into panels about 15 ft. 6 in. square and extending from basement floor to main roof. They are tied together by two lines of 12 in. I-beams lengthwise and either two lines of 10 in. I's or four lines of 10 in. channels crosswise at each floor. These extend to the wall and are anchored thereto. The 12 in. longitudinal I-beams are supported on brackets rivetted to the columns and carry the floor joists. The transverse 10 in. I-beams and channels carry no loads. The former are fastened to the flanges of the vertical channels of the built-up columns with 3 in. x 5 in. angles rivetted to their webs. At the "H" section columns the 10 in. channels are placed one on each side of the flanges, bevelled washers to fit the flanges interposed on one side, and rivetted through both channels and the flanges. Under all floors except the third, where there is an offset in the walls, a line of 15 in. channels is rivetted to the underside of the transverse struts about four inches from the wall. Starting on the offset, a reinforced concrete lining varying from four to seven inches in thickness on account of irregularity the

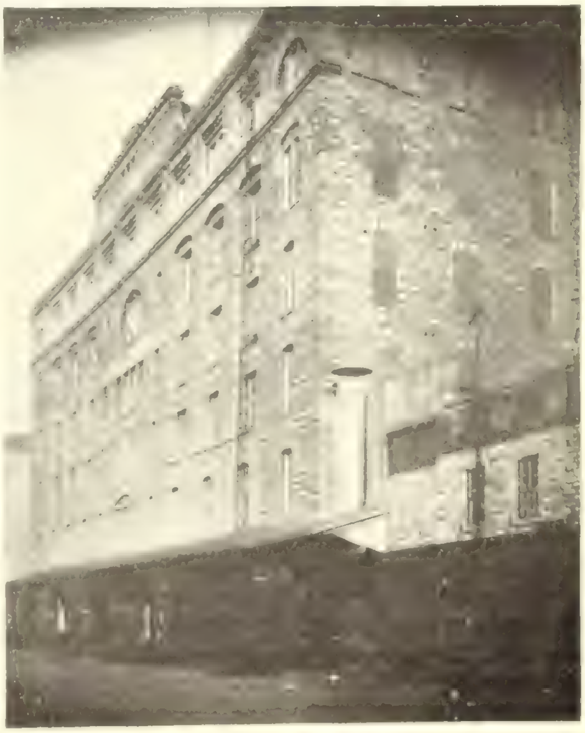


Fig. 1. Exterior of building

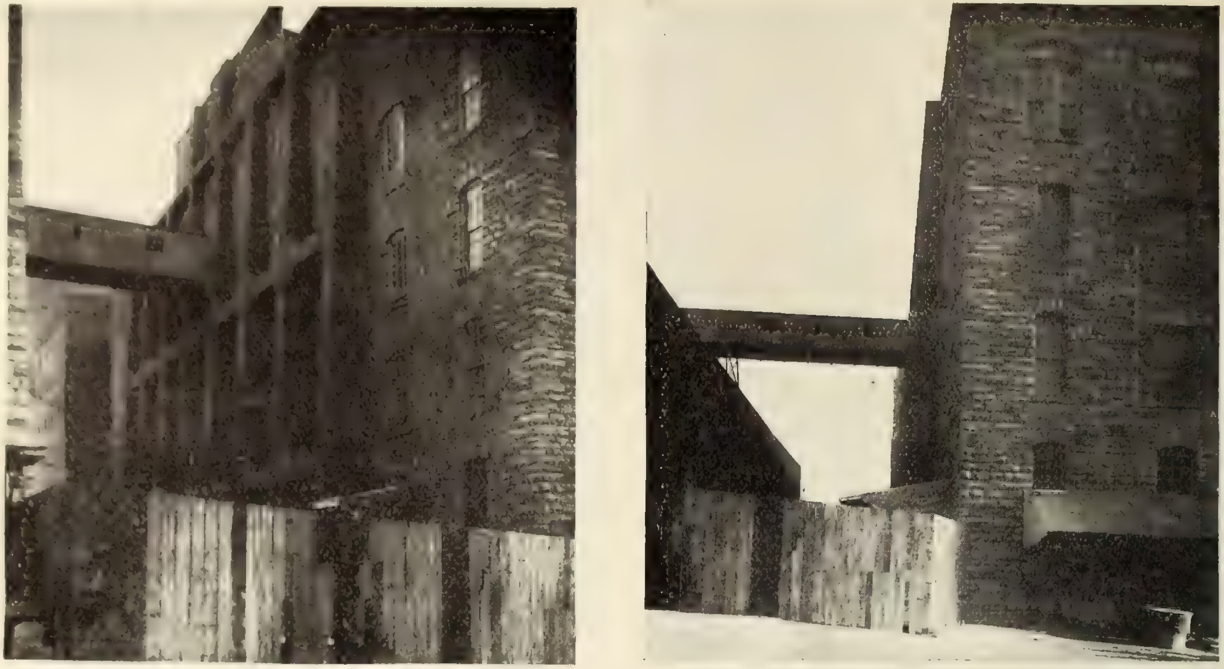


Fig. 2 Fig. 3

Monolithic reinforced concrete flying buttresses employed to strengthen the Pillsbury mill.

made to the east and west walls up to the roof and was extended a short distance on the north and south walls where they were badly cracked. The old plastering was entirely removed and the joints dug out as deep as possible with narrow chisels. The reinforcement was in general of ⅜-in. rounds spaced 12-in. centres horizontally and vertically, but ⅝-in. rounds were added to the verticals at the window jambs. New window frames with openings somewhat smaller than the old ones, were provided and the concrete continued around the jamb corners to the faces of these frames. The jambs were reinforced with number eight wire, four-inch mesh, hog netting, which was turned around the corners and extended about a foot parallel to the walls. This concrete backing binds the cracked walls into a monolithic mass, which is stronger than the walls were when new.

In the original timber construction the outer ends of the joists were carried on trimmers over some of the windows. These were removed and the joists allowed to rest on the 15-in. channels before mentioned, which in this storey were supported by the addition to the concrete lining of a 15-in. projection similar in section and reinforcement to half a "Mushroom" column head.

From the engineering standpoint, however, the main feature of the whole scheme, without which all the above described work would be useless, is the eight monolithic reinforced concrete flying buttresses (shown in Figs. 2 and 3) built from the bed rock 34 ft. below the tracks to the roof. These are located in the line of the transverse rows of columns excepting the two rows nearest the end walls, the transverse I-beams and channels extending through the east wall and being anchored into them. The two middle ones are 28-in. x 30-in. at the main roof level and 3-ft. x 9-ft. at a point 2-ft. above the tracks. The others are somewhat larger at the top as the faces are in a straight line and the wall is bulged out in the middle.

Because of a line of shafting and other machinery in the area (Fig. 4) and sewer and water pipes underneath, it was not possible to place them against the walls any further down than about two feet below the tracks. At this height they spring from the wall in a parabolic curve which brings the inside 6-ft. from the wall in a drop of 12-ft. From this height down to bed rock the inner face is vertical. About two feet above the tracks the batter of the outer face is increased to "one to one" for three feet in height to meet a timber track stringer and leave the necessary clearance at the height of a car floor. Below this the batter is 3½-in. per foot. On the bed rock the deepest buttress is 3-ft. x 15-ft. and its outer face 21-ft. from the face of the wall. The buttresses are connected together by concrete beams 18-in. x 30-in. at the second and fourth floor levels, these being close to the outer face and joined to buttresses by brackets above and below, making a total height of 6 feet and 6 in. on the side faces. They are reinforced horizontally with 8-1-in. rounds in ⅜-in. stirrups which are spaced about 15-in. centres. Each bracket has 2 1-in. rounds extending past the centres of beams and buttresses. At the main roof level is a beam 20-in. high and from 30 to 36-in. wide, its face being straight and its back fitting the wall, reinforced with 18-⅝-in. rounds, six near the top and six near the bottom throughout, the outer six being raised over the buttresses and depressed between them, stirrups being ⅜-in. round and about 15-in. centre.

The buttresses are reinforced vertically with 6 1⅛-in. rounds in a spiral of ⅜-in. round, 23-in. in diameter, 4-in. pitch, placed near the outer face and inclining with it. Near each side face of the buttresses are ⅜-in. rounds spaced 8-in. horizontally and 12-in. vertically. It was intended that these horizontal rods should extend into the stone wall, but as it was found difficult to maintain even spaces they were bent up or down at the ends and an equal number of ⅜-in. rounds 24-in. long were driven as far as possible into the joints of the stone work. The joints were all cut out

Fig. 4.—Shafting, etc., in area.

as deep as possible with narrow chisels, that the concrete might flow into them, thus obtaining a firm bond, the absolute rigidity of the joints between buttresses and wall being the vital feature of the whole scheme.

In the writer's opinion these buttresses if built of ordinary masonry could not have been made sufficiently rigid to accomplish the desired end, and in the opinion of some engineers even the monolithic ones would not do it, but "when this work was completed," to quote from a letter from Superintendent Lehman, "the vibration of the mill practically stopped. The total cost was approximately $150,000, but the mill was not shut down a single day." The cost of the interior steel work was about $120,000 and of the concrete work about $30,000.

The relative economy of using sand or concrete as a base for brick pavements was discussed at some length by Mr. Robert Hoffman, chief engineer of the Department of Public Service of Cleveland, Ohio, before the American Association for the Advancement of Science. After going exhaustively into data on cost and length of life, he draws the conclusion that an unyielding sub-base, such as concrete affords, is highly desirable, and should be supplied wherever possible, and in most cases will prove more satisfactory, even at slightly greater cost. Concrete will carry the pavement load over the many soft places caused by street openings prior to paving and will prove a greater factor of safety against settlements and irregularities liable to occur where no concrete is employed. Any settlement in a pavement foundation breaks the bond of the brick and will be rapidly followed by serious deterioration. Another possible economy in supplying a concrete foundation may be found in the possibility that some time it may be desired to replace brick with other kinds of paving material for which a concrete foundation must be supplied, such as wood block, asphalt or asphaltic concrete, in which event the cost will be materially lessened by reason of the existing concrete. In open country, with poor drainage facilities, there is no doubt, he says, that the damaging effect of frost and the yielding subsoil would soon depreciate any brick pavement with only a natural soil foundation, and under such conditions concrete is the only safe and economical foundation to use.

Rapid Foundation Work

A most interesting example of the use of hollow steel piles for rapid deep foundation work is found in connection with an operation lately conducted in West 28th street, New York City, and described by Building Age. Rock was located 38 feet below the curb and the material above it was clay and water-bearing sand. The structural steel was due in three weeks but the completion of the cellar being still ten days away the steel pile foundation method appeared to offer the only solution of the problem. Specifications were drawn which called for 85 12-in. steel piles driven to rock, blown clean by compressed air and filled with concrete reinforced with 2-in. rods.

Notwithstanding various obstructions on the ground, the shoring of adjoining buildings, etc., the driving was started on the last day of the month. The excavator was still taking out his runway while the rear half of the lot was completely driven. After he had left the ground a compressor was set up and the first pipe was blown on the 7th of the following month. Three days later all driving and cleaning had been completed and during the following two days all the piles were filled and capped, so that the entire foundation was completed several days before the expected arrival of the steel.

In another instance, where the contract called for the work to be completed in three months, the actual time required was exactly a month and a half, during which time all the excavation had been done, including sheeting, shoring, pile driving, mounting of concrete girders to carry the wall and capping of the piles ready to receive the grillage.

In this connection it may not be without interest to mention that the hollow steel piles are employed in clusters to support a building and are driven in the usual method. The steel pile sections vary in length from 20 ft. to 22 ft. and in diameter from 12 in. to 24 in. If the ground is to be penetrated to a depth greater than 22 feet the sections of piling are connected by means of a sleeve in such a manner that a watertight joint is formed. A jet of compressed air under a pressure of 150 lbs. to the square inch is then employed to blow out the earth and water contained in the shell. When this has been done the exposed rock can be examined by lowering an electric light.

After the piles in each pier have been cleaned out they are cut off at exactly the same height, a task that is exceedingly difficult when there is little room to operate. For the cutting process the oxy-acetylene torch was used. The hollow shell was next filled with concrete reinforced by 2-in. steel rods 50 ft. in length.

An idea of the carrying capacity of one of these piles may be gathered from the statement that on a single 12 in. steel pile 100 tons can be safely maintained. Piers containing 16 piles have been used and holding up to 1,500 tons are not unusual.

Rapidity of building construction is of such great importance that the method of first [illegible] excavation to rock bottom in providing a foundation has been displaced very much by the system here described.

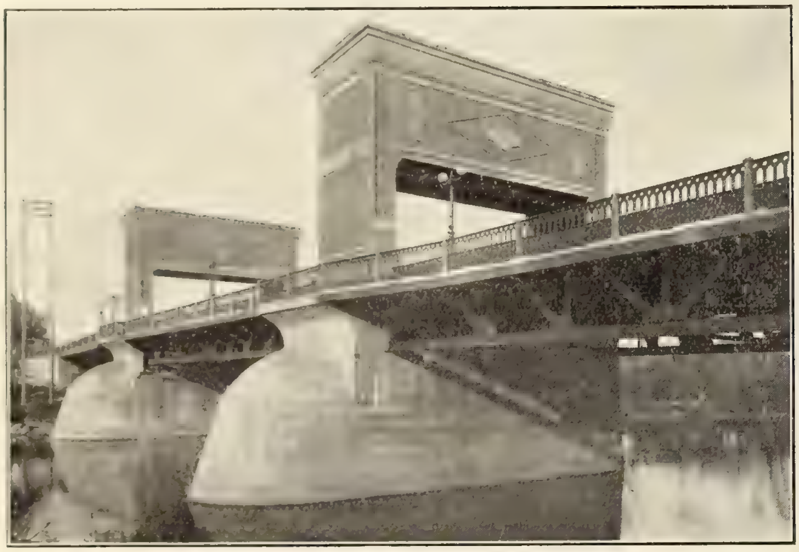
The Highway Bascule Bridges of the City of Winnipeg

Specially contributed by H. A. Mackay*

OSBORNE STREET BRIDGE

IN the building of its bridges over the different river and railway crossings, the city of Winnipeg in the past never looked far enough ahead. All the bridges were built wide enough only for the needs at the time of erection. The fact, however, that this was so may not be due to want of foresight, but to the need for building according to the money in hand. In any case the expansion of the city has exceeded the wildest dreams of the most optimistic. The result is that the city of Winnipeg is now incapable of handling with expedition the vehicular and street car traffic over its bridges. Delays are a frequent occurrence—either the street cars waiting for the vehicular traffic, or vice versa, with the attendant loss of temper to the various persons concerned. This condition is especially accentuated in connection with the bridges over the Assiniboine River, serving Fort Rouge and the rest of the city lying south of the river. This district has been built up very rapidly within the last few years, and as a result of the increased settlement the traffic has increased, but only within the last year or two has anything been done towards relieving the situation.

A comprehensive scheme of bridges across the Assiniboine River, from Main street to the city limits, is an absolute necessity for the city of Winnipeg. A start was made early in 1912 when the contract was let for a new bridge over the Assiniboine River at Osborne street to replace the old one which had become incapable of taking care of the traffic over it. At this point the river is about 300 feet wide, with sloping banks. As the river above this point is navigable, the city was forced to provide a movable span for clear passage of boats. A clear opening of 100 feet was required, and it was decided to use a double leaf Strauss Bascule Lift Bridge. The fixed portion of the bridge consists of two 90 ft. spans on the south side and one 80 ft. span on the north side, making a total over-all length of 423 ft. The trusses of the fixed spans, which are of the half through deck type, are spaced 45 ft. centre to centre, giving a clear width of 41 ft. between curbs. The street car tracks are placed 12 ft. centre to centre in the middle of the roadway, leaving a space of over 12 ft. each side for vehicular traffic. On the outside of the trusses are placed steel brackets, which carry a 6 ft. sidewalk for foot passengers. The floor is of 3½-in. creosoted wood blocks, resting on 1-in. of sand on reinforced concrete slab. The concrete is reinforced with ⅝-in. square rods. The sidewalk is also of concrete reinforced with ⅜-in. square bars. The handrail on the sidewalk is of ornamental cast iron with reinforced concrete newel posts and "T" bar rolled steel handrail.



The Osborne Street bridge of the City of Winnipeg over the Assiniboine River.

Furnished and erected by the Manitoba Bridge & Iron Works, Limited, under the supervision of Col. Ruttan, City Engineer.

The fixed spans are half deck trusses and are designed to the city of Winnipeg bridge specifications. Typical details of trusses and flood beams are shown. The moving portion is according to the Strauss Bascule Bridge Company's design and is similar to the fixed spans. The counterweight operates at a lever arm of 12 ft., and 240 tons of concrete, 15 tons of steel in the counterweight supports and 17 tons of gravel is necessary to balance each leaf, the accurate adjustment being made by the addition of loose gravel to the adjusting pockets left in the concrete. The pockets were made so that theoretically the bridge would balance when the pockets were half full of gravel, so that material could either be added or taken out as necessary. As it happened, the adjustment required the pockets to be filled almost to the top.

The overhead counterweight and supporting tower were treated as artistically as possible in a utilitarian structure and were covered with concrete plaster on

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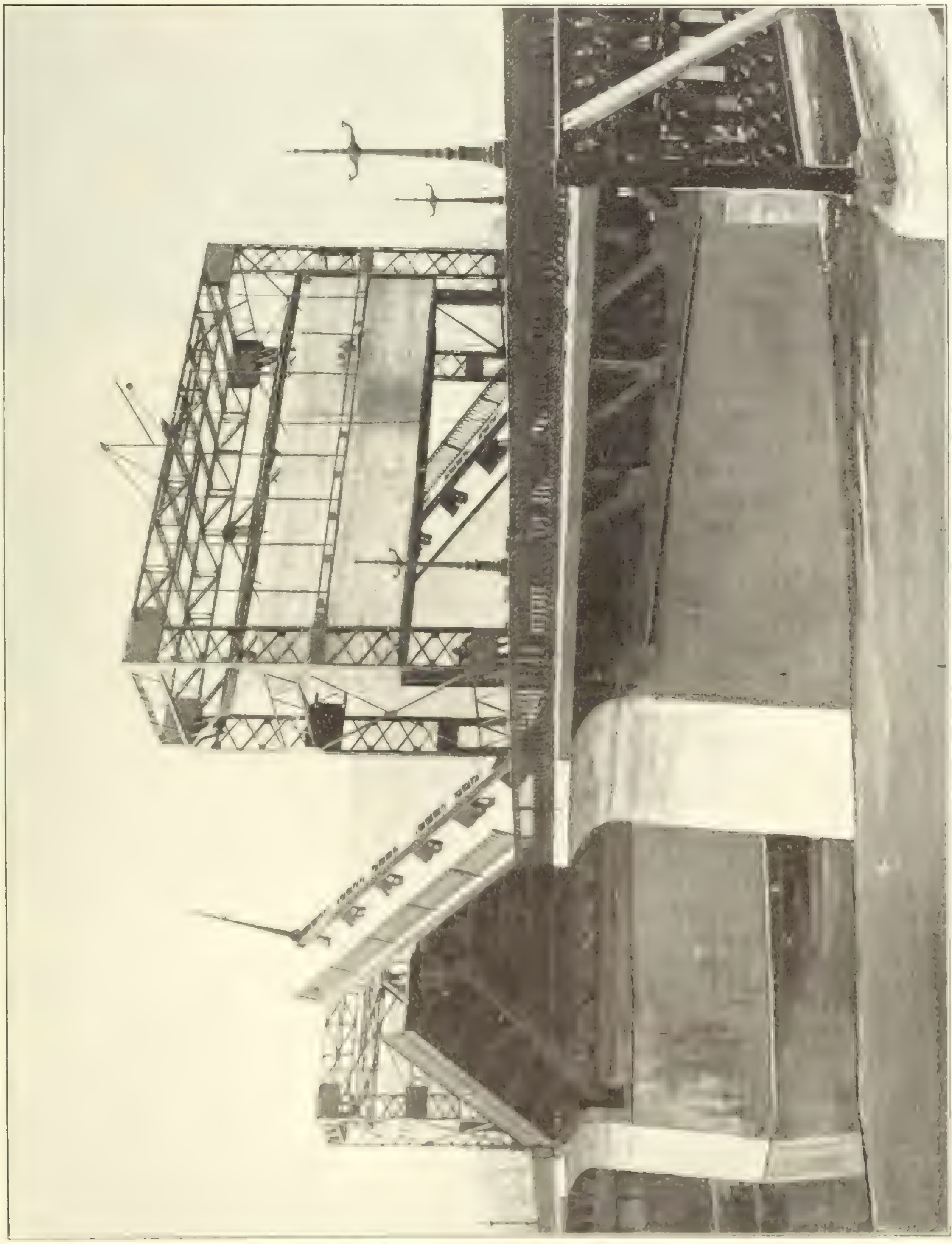
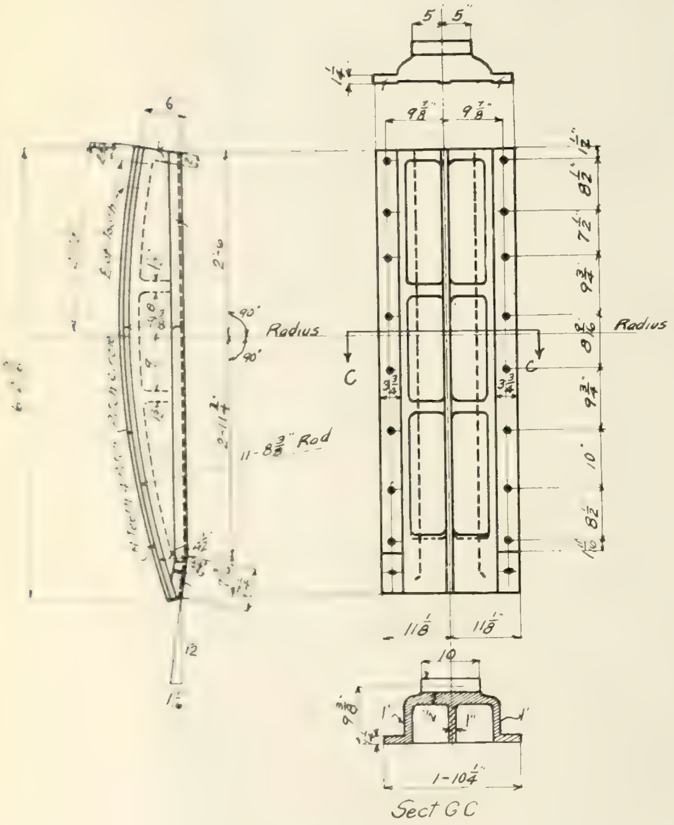
*Chief Engineer, Manitoba Bridge & Iron Works, Limited.



Double leaf bascule lift span Osborne Street, Winnipeg

St. Andrew's lock lift.



Cast steel rack.

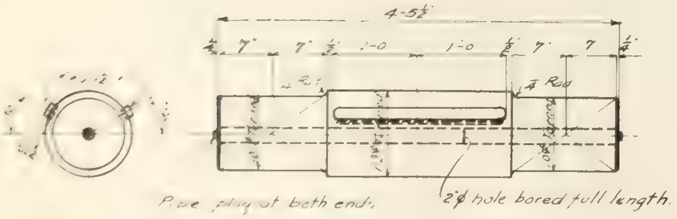
metal lath, giving as pleasing an aspect as possible. The operating mechanism is the usual Strauss design. Power is supplied from hand capstans and transmitted by means of bevel gears, spur gears and pinions to the cast steel racks which are rivetted to the heel of the truss. Should it be necessary to open the bridge quickly at any time, motor power can be applied. In testing it was found that four men can easily open the span. The bridge has been open for a considerable time and has given great satisfaction.

HIGHWAY APPROACHES TO BRIDGE OVER ST. ANDREWS DAM

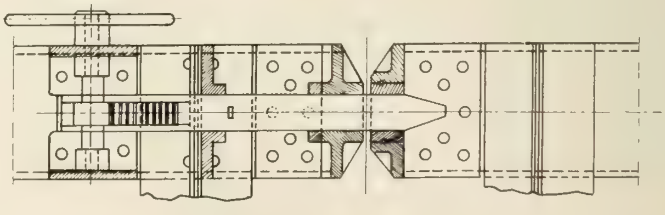
When the St. Andrews Dam on the Red River at Lockport, some twenty miles north of Winnipeg, was built some years ago, all provisions were made on steel work for a highway on top of the dam. During 1913 the necessary approaches were erected on both the east and west sides, and now settlers on both sides have access to one another without requiring to use the slow-moving ferry in summer or to take to the ice in winter.

The east approach is of the ordinary steel trestle type with plate girders, steel floor beams and stringers for supporting the roadway, the longest single span being 59 ft. This approach is on a five per cent. grade and the total length of the steel work is about 240 ft. The clear width of the roadway is 22 ft. The flooring is composed of 4-in. sub-planking, with a 2-in.

(Description concluded p. 393)

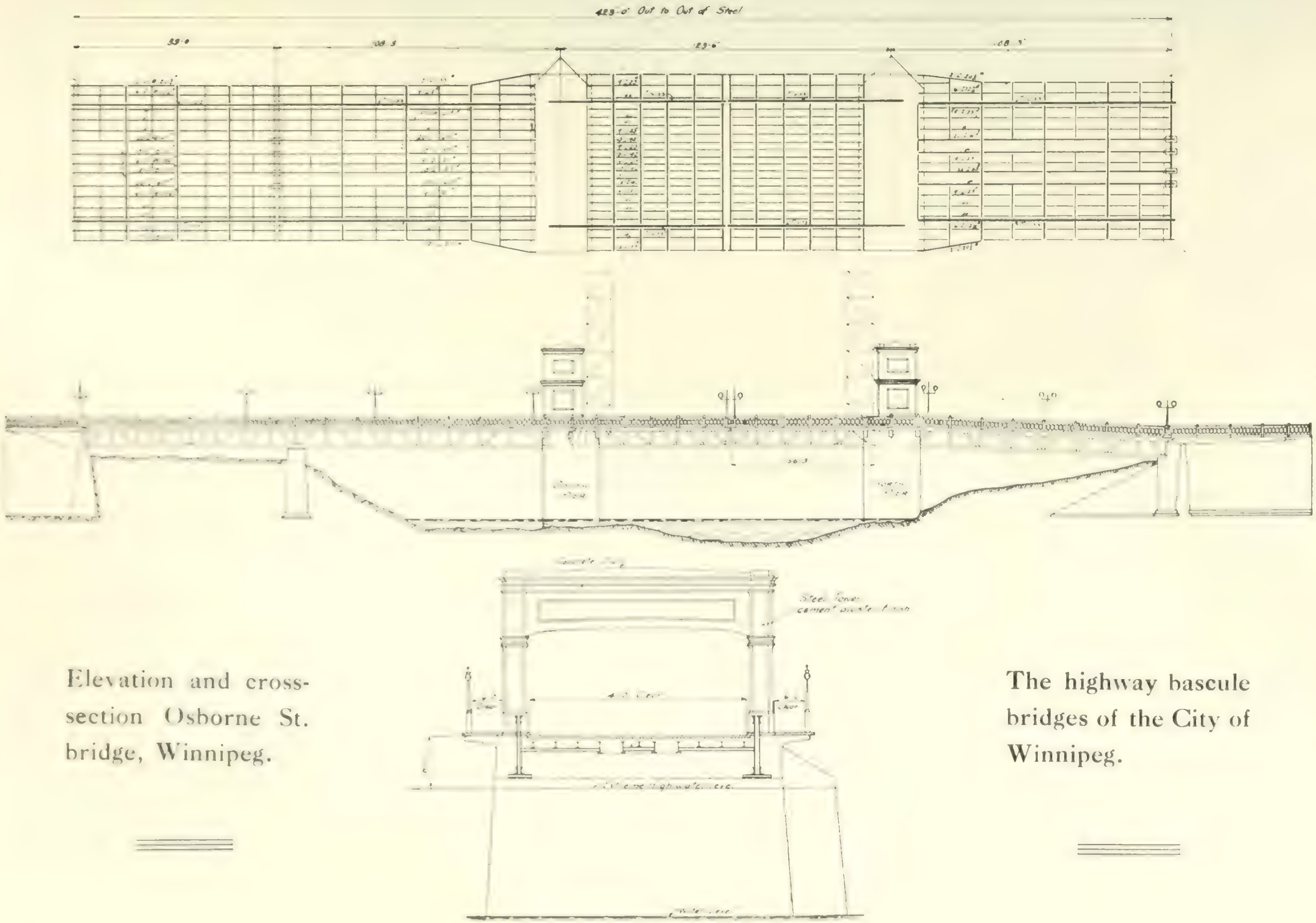


Trunnion



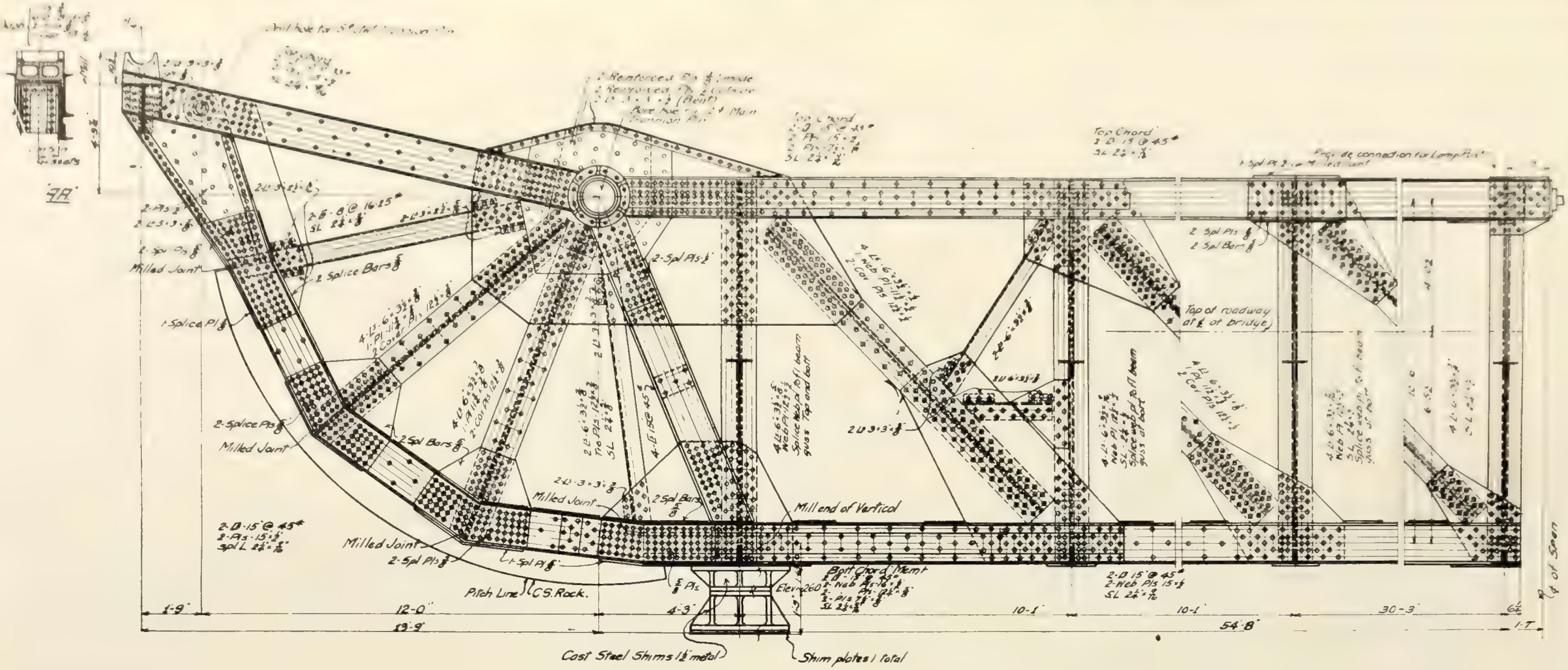
Lock between opening spans.

Details of Parts of Machinery, Osborne Street Bridge, Winnipeg.

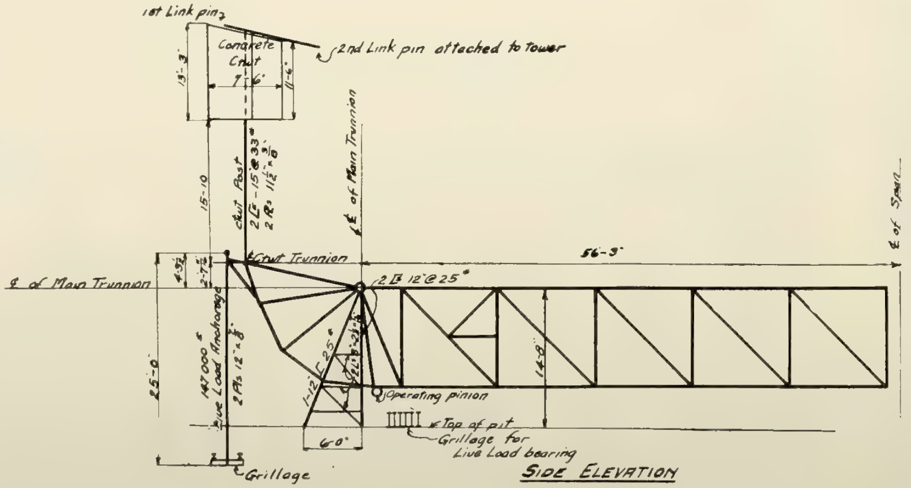


Elevation and cross-section Osborne St. bridge, Winnipeg.

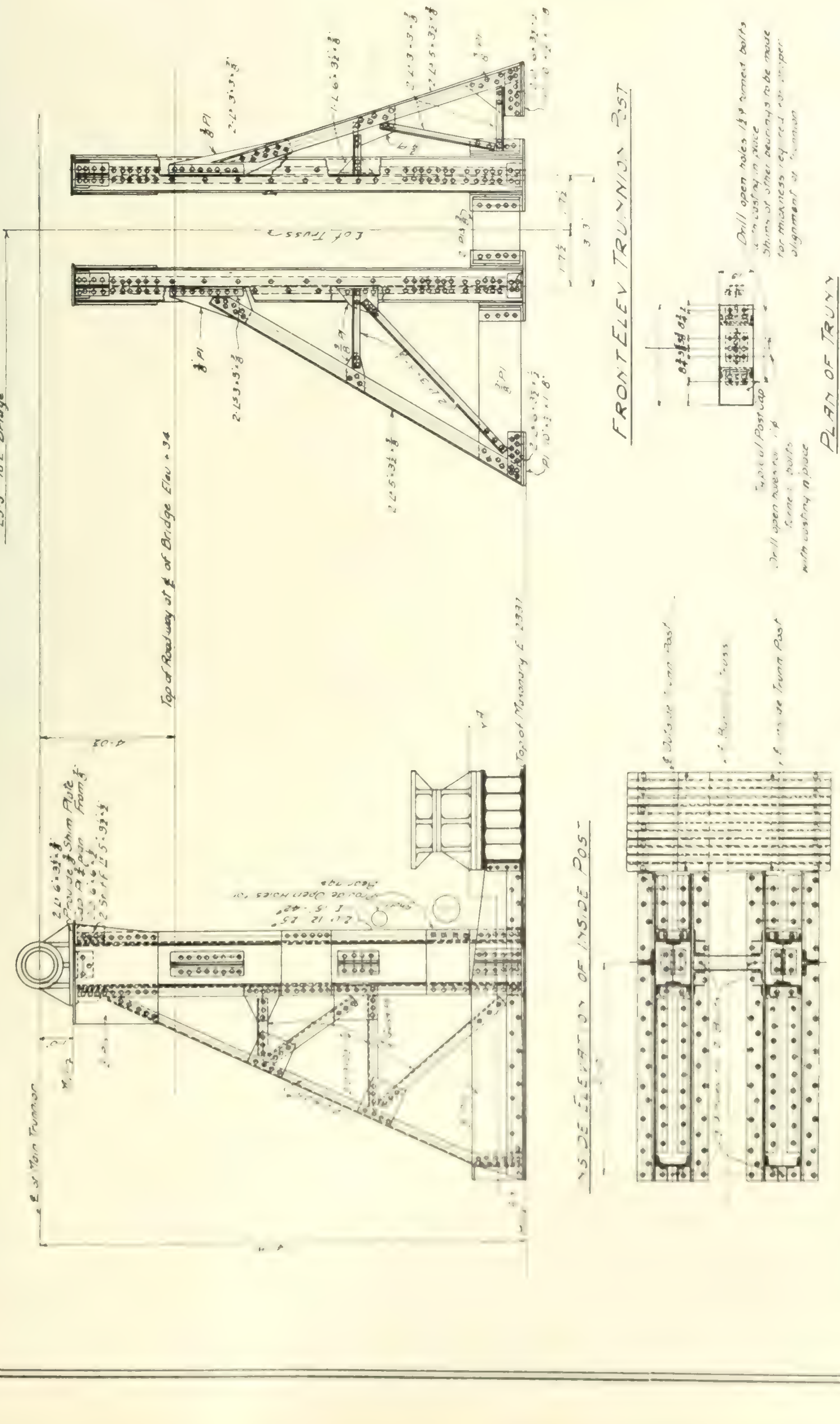
The highway bascule bridges of the City of Winnipeg.



Detail of bascule truss at Osborne Street bridge, Winnipeg.

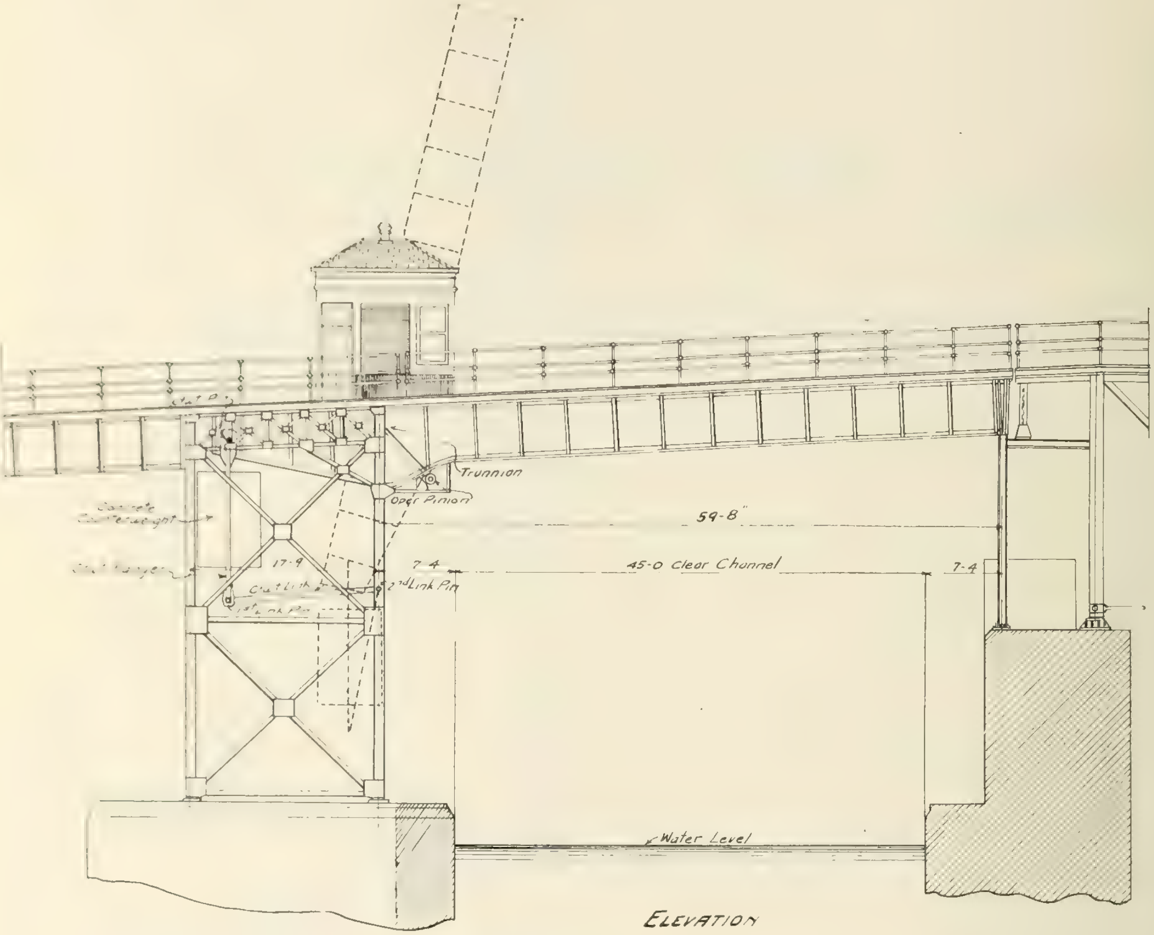


The highway bascule bridges of the City of Winnipeg.

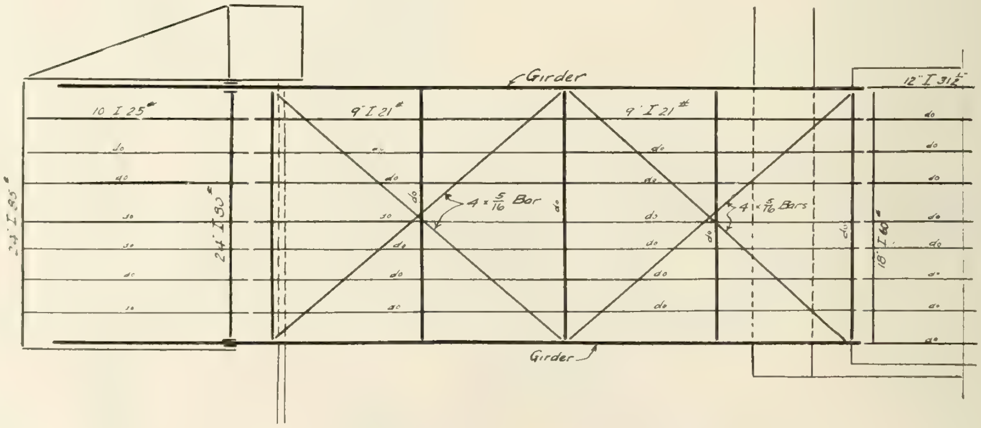


Design of trunnion post Osborne Street bridge Winnipeg

The highway bascule bridges of the City of Winnipeg



ELEVATION



FLOOR PLAN OF STEEL

Plan and elevation of bascule span at St. Andrews lock.

The highway bascule bridges of the City of Winnipeg plank wearing surface on top. Each side of the bridge is provided with a three-line gas pipe rail.

The west approach, not including the main tower and the span over the locks, is somewhat similar to the east, with the exception that it is on a curve, the total length on the centre line being about 140 ft. The main tower is 17 ft. 9 in. centres of columns.

The span over the locks and adjoining the old bridge is a lift bridge of the Strauss Bascule type and spans the locks (59 ft. 8 in.) with one leaf. This leaf is composed of two plate girders and flooring similar to that on the other parts of the approaches. The counterweight for balancing the span is composed of a concrete block built around a steel frame and weighs approximately 83 tons. It is placed beneath the roadway of the bridge in the main tower. The operating machinery is also in this tower. The equipment includes a 15 h.p. motor for raising the span to enable boats to pass under while going through the locks. The operator's house is on top of the roadway and is connected with the north side of the main tower. It is provided with all the necessary switches and brakes for operating the machinery below.

This span was given its official test in November, 1913, and its efficiency was proved beyond a doubt, it being raised from its normal horizontal position to one almost perpendicular with the roadway and then lowered to the horizontal again in one minute and forty seconds.

Both the above bridges have been supplied and erected by the Manitoba Bridge & Iron Works Limited, Winnipeg, the Osborne Street Bridge under the supervision of Col. Ruttan, City Engineer of Winnipeg, and the St. Andrews Dam approaches under the supervision of Prof. Brydone-Jack, Winnipeg, Consulting Engineer to the Dominion Government.

The Art of Making Rapid and Reliable Preliminary Estimates of Cost

By Allen Hazen, Consulting Civil Engineer, New York City

ESTIMATING the cost of constructing proposed or existing structures rapidly and surely is an art. It is a valuable art and deserves cultivation. The success of many undertakings depends upon its use. Some men have the knack of estimating; others can never learn it. But good methods are essential and these can be studied and perfected and applied to special problems.

Estimates made for different purposes, are prepared in quite different ways according to circumstances. They may be conveniently classified under three headings:

(1) Preliminary estimates, being estimates made in advance of the preparation of detailed plans and specifications for the purpose of discussing a project for deciding as to its adoption, and for making the necessary financial arrangements for carrying it out.

(2) Detailed estimates, being estimates based upon detailed plans for the execution of the work, and usually made shortly before bids are asked for the particular work covered, or in advance of undertaking to carry it out by day labor.

(3) Final estimates, being the estimates to the contractor at contract prices for the actual work done. The term "final estimate" may also properly be applied to a statement of the cost of a completed work based upon actual expenditures made for carrying it out.

That which follows relates only to preliminary estimates.

Preliminary estimates are made much more frequently than others because only a fraction of the projects for which estimates are made are carried out. Less precision is expected in preliminary estimates than in detailed or final estimates, but on the other hand all reasonably attainable accuracy is desirable, for many important matters depend upon it. The decision as to which of two or more alternate projects is to be adopted frequently turns upon the preliminary estimates of the respective costs. The decision as to whether or not to undertake a certain enterprise usually turns upon the preliminary estimate of the cost of the work. A certain degree of reliability is, therefore, essential in preliminary estimates. On the other hand, preliminary estimates must be made for many enterprises that will never be carried out, and it is necessary that they should be made rapidly and without undue expense to the client.

Basis for Preliminary Estimates

There is only one real reliable basis for preliminary estimates. It is, the consideration of final estimates of work previously carried out, of a character and magnitude as nearly as may be similar to that of the proposed work. The more nearly the work represented by these final estimates approaches in all the conditions that for which estimates are being made, the more reliable, in general, are the preliminary estimates based upon it; and the more numerous and greater the points of divergence, the less reliable is the basis and the greater is the probable error in the resulting preliminary estimate.

Estimates in Valuation Proceedings

When a property such as a water works property is to be valued for the purpose of sale, it is common for engineers to make estimates of the cost of reproduction for the structures. These estimates may be in the nature of final estimates when the structures were recently completed and the actual costs are shown by records. They may be in the nature of detailed estimates when full plans and quantity schedules are available. More often they are in the nature of preliminary estimates because such detailed information and cost are not available. Preliminary estimates made in this way are commonly subject to comparison with like estimates made by engineers representing the other party to the transaction, and it is frequently necessary to harmonize such estimates by arbitration or otherwise. If they are presented as evidence in court the engineers who made them must support them through a searching cross-examination. The criticism of preliminary estimates made in this way is likely to be more searching than that of estimates made in the ordinary course of business, where the estimates are made for the purpose of construction and comparison only. For this reason the experience gained in valuing properties for the purpose of sale and in condemnation cases is more useful than any other experience that an engineer can have in training him in the first elements of sound procedure in making preliminary estimates.

Methods of Comparison

The problem presented in making preliminary estimates is this: given the final estimates of a certain number of works, more or less comparable to the one proposed, and a general outline of the works for which an estimate is to be made to find the probable fair reasonable cost of construction of the proposed works. The general procedure is to find the elements of cost in the work that is to be carried out, and the actual cost of those elements in the works for which final estimates are available, and to apply the latter to the former. In doing this all known differences that would affect, to an important extent, the probable cost of the work, must be taken into account and allowed for to the best of the estimator's ability.

Basis of Estimate

An estimate may be said to be low, fair, or liberal, according to the methods used in making it. A fair estimate may be defined as one such that with the work carried out in a business-like way under average conditions, there is somewhat more than an even chance that the work could be completed within the estimate. In the case of structures of types that have been built frequently, and of which the elements of cost have been well determined, experience indicates that it is possible in most cases to approximate, in preliminary estimates, the cost of new structures within 10 per cent. of the actual cost. With such structures a fair estimate would be somewhat between the most probable cost and 10 per cent. more than this, or, in a general way, 5 per cent, above the most probable cost. With an estimate made in this way, it should be possible to keep the actual cost of construction within the estimate three times out of four, and this is figuring as closely as an engineer can be expected to do.

In the case of structures of greater novelty, or structures involving undetermined underground conditions, greater fluctuations must be anticipated and the above-mentioned percentages should be increased.

Erroneous Methods of Reaching Estimates

In a valuation proceeding, it is frequently surprising that reputable engineers will present on different sides, estimates differing so much for the same item. These differences must frequently grow out of the use of erroneous methods of procedure by the respective engineers. It may be well, therefore, to consider some of the commonest methods that are erroneous, and to point out the reasons why they should not be used.

The Contract Price Method.—The columns of the technical journals contain a record of the prices at which many contracts are awarded. By going through these columns and selecting the low bids and applying them to the proposed work, an estimate may be prepared which will probably be much below a fair estimate for the work. Among the reasons that it would probably be low are the following:

First, many of the low bidders have under-estimated the difficulties of the work, and their bids are really too low. That is, they are not sufficient properly to carry out the work and make a fair profit. The contractor may not be able to complete the work under the contract and additional expense to the owner will have to be met.

Second, in applying the bid prices, or contract prices to new work, it is very easy to overlook entirely some items in the work. A price that relates to a part of the work may be taken as applying to the whole of it through ignorance or failure to make a fair and full comparison.

Third, the schedule of quantities prepared by the engineer for use in the specifications on which bids were obtained may be inaccurate and may not correspond with the final quantities when the work is completed.

Fourth, the items of extra work growing out of conditions that either were not anticipated, or that were intentionally excluded from the contract by the engineer as a matter of policy, are overlooked and ignored.

For these and similar reasons, estimates prepared from contract prices, or from low bids reported are almost invariably too low and frequently may be too low by a very large percentage. The figures may be arranged to make a very convincing showing in support of it, but it remains notwithstanding a low estimate.

Estimates Based on Averages.—In many municipal and corporate reports one may find records of the monies actually expended in carrying out certain developments. It is easy to find such records and to compile them and to deduce from them a figure which may be used as representing the probable cost of a proposed work of similar character. Some works represented by such figures may have been done in an efficient and economical manner, and the figures so obtained may be reliable and proper ones for use. Frequently, some or all of the work taken for use in this way was done under conditions that were not efficient, and the cost of doing it may include other items than those relating to the construction work. It is easy to select data in this way to back up a high estimate, and to make a showing that is convincing to those not familiar with the methods.

A Fair Basis of Estimate

A fair basis of estimate does not exclude either of the above methods, but will take into account data secured under either for what it is worth, and will make allowances for the conditions, or supposed conditions, under which the bids were received, or the work was done. A fair basis of estimate will also give much greater weight to final estimates of work as comparable as may be to the work that is proposed ,where the work was done under conditions known to be careful and economical. The engineer in making such estimates will naturally and rightly give greatest attention to work done under his own direction, and will give second place to work done by his friends and acquaintances with which he is reasonably familiar as to conditions met and methods used in the construction.

The Weighted Price Method

The number of different kinds of work for which unit prices may be obtained is very great. If an effort is made to keep track of the amount of work of each kind, and to estimate the amount of it in the proposed work, the schedule will be too complicated and the labor of applying the figures will be unduly increased. Moreover, if the schedule used for comparison is too complicated, some items are sure to be overlooked, with the result that too low a final figure will be reached. In order to prevent both of these conditions it is frequently best, in preparing preliminary estimates, to take only a limited number of the main items of work that are involved in the kind of construction that is contemplated, and to weight the unit prices for them in such a way that they will include the whole cost of all the incidental items naturally associated with them.

In proceeding in this way one selects first the items that are to be used. These items should be so selected as to include directly the major part of the work. The final estimates that are to be used as a basis are then taken for analysis. The whole cost of the work represented by each is then distributed among the selected items. Considerable judgment is required in the distribution, and each part of the construction should be included with the item to which it is most nearly related. The most important point is that every dollar spent should be charged under some one of the selected headings.

The sum of the costs reached in this way, divided by the quantities in the final estimate, gives new unit prices which are weighted to include all the minor items. Applying these unit prices to the main items of the proposed work gives a basis for preliminary estimate.

As illustrations of these methods, take the case of pipe-laying. The trenching, the lead, the cast iron pipe, the teaming and incidental expenses may all be represented by separate items in the final estimate that serves as a basis. These can obviously be consolidated into a single item per lineal foot of pipe of a given size. In this process the price for pipe is weighted to include the other expenses that naturally go with it. The process may be carried further and the pipe still loaded to include the gates, the hydrants and all auxiliary structures.

In a similar way the cost of the reinforcing and of the forms for concrete construction first stated as separate items, may be consolidated, and all the different classes of concrete may be brought into one so that a unit price for masonry includes reinforcing and forms, and all the appurtenances that go with the masonry structures.

In estimating the cost of sand filters the writer has for years divided the whole cost of the construction into four parts, as follows:

(1) Excavation and earth work.
(2) Masonry.
(3) Filtering materials.
(4) Piping and auxiliaries.

The cost of each plant built worked out in this way on a uniform basis affords a basis for rapid and accurate comparisons, and allows the data to be applied in making preliminary estimates for new work where the prime conditions of construction are known with comparatively little chance of large error.

Weighted unit prices of this kind must be carefully obtained and can only be used with caution. The amount of weighting must always be kept clearly in mind by those who use them. When properly deduced and used, they afford an extremely useful and rapid method of approximating the cost of many structures.

The Ratio Method

There are many cases where the system of weighted unit prices cannot be used because the schedules in the final estimates that serve as a basis are in such form that unit prices cannot be deduced from them. For example, there are many cases where the amount and character of work are known and the total cost of the work is known, but there is no way of sub-dividing it between the different items. To compare the costs of different pieces of work with each other, and to get a basis for estimating the probable cost of other similar work is then much more difficult.

A method of reaching an approximate and useful solution of this problem is one which may be called the ratio method. A schedule is made of a limited number of items of work which represent the greater part of the construction in the several cases. A simple schedule of unit prices is then formed corresponding to the units. One fixed price is assumed for each kind of work. The price assumed should be a reasonable one, but precision is not to be expected and a round figure may always be used. The amount of work under each item in each job is ascertained and the assumed prices are applied to them. The sum of the amounts for each job represents what that job would have cost at the assumed prices. A comparison between the actual cost and the cost at the assumed prices gives an idea of the relative economy of the work. It may be found, for example, that one piece of work cost 20 per cent. more than the amount obtained by applying the assumed prices; another piece of work cost 12 per cent. more and a third, 7 per cent. less. When the records of a number of known pieces of work are compared in this way, it furnishes a basis for making a preliminary estimate for work of the same class. In doing this the quantities for the proposed work are ascertained, the base prices are applied to them and a ratio by which the sum so reached is to be increased or diminished is ascertained by consideration of the ratios actually found to have been obtained in the jobs for which cost records are at hand.

In arriving at the ratio to be used the engineer will compare, perhaps in his mind and without written schedules, the ease or difficulty of the proposed work as compared with the ease or difficulty of the various works which served as a base; will take into account the known or assumed efficiency or lack of efficiency in the execution of the several pieces of work from which his basic data were derived, and will reach an estimate of the addition or subtraction to be made to or from the base price in each case.

This method is commonly combined with the preceding. That is to say, the base prices are usually loaded prices.

This method affords a convenient and efficient method of comparing the relative costs of different works where the loaded unit price method cannot be applied and in experienced hands it affords a rapid and reliable method of making preliminary estimates upon many classes of structure.

Extra Cost of Novel Designs

Work on novel designs commonly costs more than work following standard designs. This is true even when well tried methods are first introduced in new places. Such work may be too small to attract bidders from a distance. The unit cost will then overrun anticipated prices. An under estimate of cost is frequently made on work because the estimator fails to realize what a great effect familiarity with the methods of performing work has upon the cost. To realize this one has but to think of the difference between present methods and cost of building tunnels and subways and deep foundations and the methods in use of only 15 or 20 years ago. Not only is the [illegible] which the contractor takes now less but methods which have been thoroughly tried out are at his disposal as well as experienced foremen and laborers to do the work more economically. For a structure of new or novel design much caution in using prices that may be standard on other kinds of work must be used.

Small Jobs Cost More in Proportion than Large Ones

Another common cause of under estimating costs is the use of figures on large pieces of work for estimating small work. The engineer often overlooks the large cost of overhead charges, the waste of labor and the cost of plant caused by organizing a force to perform a small piece of work. He too often forgets that for small work the work must be done by less efficient methods or the cost of plant prohibits the use of expensive machines. Perhaps the most common case of such under-estimating is where the job, although a large one in the aggregate, consists of many small pieces of work of widely varied character. Such a job is troublesome and costly for the contractor and the experienced man knows it and puts in a corresponding bid.

It must be remembered that bids follow the law of supply and demand; the general slackness in construction work calls out bidders and low prices. The condition of the money market, the cost of materials and the general opinion of the condition of contract work are of course matters of much importance. It seems scarcely necessary to say that the engineer should know where and how the contractor is to obtain his materials and have a fairly definite idea of the cost either in dollars and cents or as a comparative figure to other work.

The engineer in estimating should try to look at the work from the standpoint of the contractor, should try to remember that no work runs as smoothly along as the contractor wishes, that labor conditions and other matters often spoil the best laid plans. He should endeavor to keep in mind the various work he has watched or performed and the numerous times when unexpected conditions added largely to the cost.

Generally speaking, estimates on proposed work by men of limited experience are too low, yet it is not unusual for an engineer to be so impressed with the difficulty of a piece of work that he overestimates the actual cost and it is more common to find that he has overestimated the bids of the contractors.

It is of much value to have two methods of arriving at estimates. If an independent check method can be made even though a rough one, a failure of the two results to agree often leads to the discovery of serious errors in the application of one or the other method.

Conditions of Success in Estimating

One of the first requisites for successful estimating is a fair and unprejudiced, and moderately pessimistic mind. The estimator must be alert for new and cheaper processes and methods, and conservatively sceptical concerning their merits. Moreover, a successful estimator must have had experience in actual construction. As a general rule an engineer should not make an estimate for a structure that he would not know how to build.

Next, as a requisite to successful estimating, may be mentioned a broad basis of cost records of actual work, more or less similar to that for which estimates are to be made. A good and safe method of using the cost data and adjusting it for application to new conditions is equally important.

And, finally, the estimator must have the will to refuse to make estimates for work that he does not understand.—Engineering and Contracting.

Constructional features of the B.C. Division of the Canadian Northern Pacific Railway

THE total length of the main line of the above railway in British Columbia is five hundred miles. Approximately sixty miles remain to be graded. The principal contractors are the Northern Construction Company, who have the section from Port Mann to Hope and who are also associated with the line from Hope to Kamloops and from Kamloops to Yellowhead Pass. In all, between Port Mann and Yellowhead Pass, there are fifteen divisions. The length of the division is determined by the difficulty of the work. The divisions range from thirty to sixty miles in length. During the winter months the maximum survey force was 180 men. No great difficulty was encountered owing to weather conditions except in the Fraser and Thompson canyons, where work was carried on under extreme danger on account of the rock and clay bluffs.

The ruling west-bound grade is 4/10 of 1 per cent., compensated, and extends for fourteen miles. The ruling east-bound grade is seven-tenths. The heaviest cost for a single mile of grading, exclusive of tunnels, track work or structures, was $198,000, the yardage represented being rather more than 240,000 cu. yds. The length of rock fill in the Fraser River bay at the west end of the Sumas Mountain is 500 ft., representing 49,500 cu. yds. The width of the Thompson slide, where the Canadian Northern Pacific railway crosses, is approximately 500 ft. At this point over 100,000 cu. yds. were taken down. Monitors (manufactured by the Phoenix Iron Works, Portland, Ore.) with 2½ in. to 4 in. diameter nozzles were used. The water pressure was 120 lbs. per square inch. The water was supplied from 12 in. and 14 in. pipes from a creek distant about a half mile from the work.

Where the work was carried on over the Grand Trunk Pacific in the vicinity of Moose Lake, six trestles, located about 1,000 ft. apart, were erected for the purpose of taking care of the material.

In all there are 44 tunnels in British Columbia between Port Mann and Yellowhead Pass. The total length of these tunnels is 23,704 ft., the construction having been chiefly through solid rock. A large proportion of the tunnels required timber lining.

At the annual meeting of the Canadian Fairbanks-Morse Company, Montreal, last week, the president, Mr. H. J. Fuller, expressed the opinion that the business situation in Canada, which had resulted from the over-exploitation of lands and real estate, had re-acted to a healthy basis. Undoubtedly the country would have to go through a trying period of re-adjustment, but with the gradual easing of the money situation and the continuous flow of emigration there could be no question as to the ultimate future of the country. The Fairbanks-Morse Company's net profit for 1913 was $224,792.

A brick that, experts declare, was absorbed by natural growth round it two hundred years ago, has been found in a beech tree, computed to be five hundred years old, which has just been felled at Shardeloes, Amersham.

Specifications for Reinforced Concrete Highway Bridges and Culverts

THE following recommendations were submitted to the American Concrete Institute, at its recent annual convention in Chicago, by the Committee on Reinforced Concrete Highway Bridges and Culverts. These recommendations were submitted, not as final, but merely as preliminary suggestions, in the hope of bringing out the discussion of doubtful points and information regarding questions which the committee could not answer.

Dead Loads

The following are given as average weights per cubic foot of the materials mentioned, but if the weights of the materials to be actually used are definitely known to be different from those given, the correct weights should be used:

Materials	Lbs. per cu ft.
Earth filling	110
Plain concrete	150
Reinforced concrete	155
Steel	490
Cast iron	450
Vitrified brick	140
Common brick	125
Granite and limestone masonry	165
Sandstone	160
Macadam-Telford	150
Pine, fir, etc.	42
Oak and yellow pine	48
Creosoted timber	60

The weight imposed by earth filling should, in ordinary cases, be considered as including all filling included between vertical planes passing through the faces of the abutments.

If, however, the height of the fill exceeds about two-thirds the distance face to face of the abutments, the live load may be neglected and a very considerable proportion of the weight of the filling considered will be supported by friction between it and the approach filling. The amount of load thus transmitted is greatly affected by the cohesion of the soil, of which there is nearly always more or less.

This whole subject requires further investigation.

Live Loads

Class "A" Bridges.—Main thoroughfares leading from large towns.

In view of the extensive introduction of the heavy motor trucks and traction engines, and the probable general use of such vehicles in the future, it is recommended that bridges on main thoroughfares and other roads which are likely to be used for heavy hauling, be designed to carry 20-ton trucks, with axles about 10 ft. center to center, 14 tons on rear axle and 6 tons on fore axle; wheels about 5 ft. center to center. Outside of the large cities it is recommended that only one such vehicle be assumed to be on the bridge at any one time, the likelihood of more than one being on the bridge, in a position to produce maximum stresses at the same time, is so remote that this assumption is considered as occupying only the ordinary width of the road, about 8 ft. in width and about 35 ft. in length. Congested traffic of heavily loaded wagons or motor trucks will rarely impose a load of more than 100 lbs. per square foot, over a considerable area. The above mentioned 20-ton truck gives a load of about 140 lbs. per square foot on the area actually occupied, but it is considered extravagant to assume that a large bridge is covered with such heavy loads. A load of 100 lbs. per square foot is thought ample to assume for the loading of spans more than 60 ft. long, in designing the trusses or main girders. It is thought to be safe to reduce this assumed load in the case of longer spans, to the following values:

Length of span, ft.	Assumed load, lbs. per sq. ft.
80	90
100	80
125	75
200 and over	70

With all intermediate spans in proportion.

The greatest load that is liable to be imposed on a bridge sidewalk occurs when there is some excitement in the neighborhood, which attracts a large crowd, and for which the bridge affords an especially good point of view. In that case the crowd forms a compact mass, against the railing, not more than 4 ft. deep, making a load seldom exceeding 100 lbs. per square foot over a very considerable space. The remaining portion of the sidewalk may be covered by a moving crowd which can scarcely weigh more than 40 lbs. per square foot. It may be advisable, sometimes, to so design sidewalk slabs that if a street car or motor truck accidentally gets upon the sidewalk it will not go through. Such accidents are so rare that it is thought safe to allow materials to be stressed somewhat beyond the elastic limit in such cases.

Class "B" Bridges.—Although it is impossible to determine beforehand, especially in the newer parts of the country, whether any given road is to be used for heavy traffic, it seems extravagant, at least in the case of larger spans, to design bridges to carry much heavier loads than can be expected to come upon them. It is recommended that bridges of this class be designed to carry 15-ton trucks, with axles 10 ft. apart, 5 tons on the front and 10 tons on the rear axle. This will allow for a considerable overloading of existing motor trucks. It is further recommended that only one truck be assumed to be on the bridge at one time, in designing the floor system, that it be assumed to cover a width of 8 ft. and a length of 35 ft. and that the remainder of the bridge is covered with a load of about 80 lbs. per square foot for spans up to 60 ft.

The longer spans, the trusses and main girders should be designed for the following loads:

Length of span, ft.	Assumed load, lbs. per sq. ft.
80	80
100	70
125	65
150	60
200 and over	55

Sidewalks should be designed to carry the same loads as in the case of Class "A" bridges.

Special Bridges.—City bridges and bridges carrying traffic connected with mines, quarries, lumber gions, mills, manufactories, etc., require special consideration and should of course be designed to carry any load which can reasonably be expected to pass over them, bearing in mind the likelihood of heavy traction engines and motor trucks coming into extensive use in the not distant future.

Stringer Loading.—The maximum stress in a stringer, due to a wheel load, occurs evidently when the wheel is directly over it. It is not thought proper to assume any distribution of the load to adjacent stringers, unless the bottom reinforcement in the slab is made continuous. In that case the distribution is proportional to the relative stiffness of the slab and the stringers, said stiffness being proportional to the moments of inertia multiplied by the modulus of elasticity of materials, and inversely proportional to the cube of the span. In determining this distribution, due account must be taken of the fact that deflection of the slab decreases toward the end of the stringers, and also of the fact that whatever load is carried to the adjacent stringers deflects them also. It is therefore recommended that wherever practicable the bottom reinforcement of slabs be more continuous over the stringers.

Slab Loading.—The distribution in a direction parallel to the supports of a concentrated load resting on a slab, supported at two opposite edges only, evidently depends upon the same principles as those mentioned under "Stringer Loading." The main difference being that what corresponds to the stringer in the former case is of indefinite width in the present case. Adequate theoretical investigations of this question appear to be lacking. For the present it seems fair to assume that the distribution each side of a concentrated load is equal to about one-third the length of the span, and that the cross reinforcement should be designed accordingly, which would require it to have an area of at least one-half of the principal reinforcement. The distribution of a concentrated load through earth filling on the top of a slab does not appear to be very well understood.

Bridges Carrying Electric Cars.—Electric traction is still in its infancy and nobody is able to forecast its future development. It seems probable, however, that it will not be profitable to run cars weighing more than 50 tons each, at a speed that would be permitted on any public road. If very high speeds are desired, the traction company will doubtless be required to operate over its own right-of-way. It is recommended that bridges carrying either urban or interurban electric cars be designed to carry 50-ton cars on two trucks, spaced 30 ft. centre to centre, each truck having two axles spaced 7 ft. centre to centre. The committee sees no reason for changing the customary practice of assuming that an axle load is distributed over three ties.

Loading on Arches.—The deflection of an arch being much less than that of a beam of the same length, the method recommended for determining the lateral distribution of a concentrated load over arch sheeting appears to be different from the distribution over flat slabs. It seems doubtful if the distribution in each direction can be greater than twice the thickness of the arch sheeting. This question should be investigated.

Stresses in Arches.—As all arches that are not provided with hinges act as elastic arches until cracks are formed, due to excessive tension at some point or points in the concrete, it is manifestly proper to calculate the stresses in them according to the elastic theory.

As concrete is a very poor conductor of heat, it is not thought necessary in calculating reinforced concrete arches to assume so much variation in temperature as is usual in designing steel structures, although the outside layers of concrete are of nearly the same temperature as the surrounding air, and those layers are stressed more heavily than any of the others. It is thought that an extreme variation of about 80 deg. F. in the northern states is sufficient to allow for, in any case, and that can be reduced if the arch ring is thicker or if there is much earth filling in the spandrels.

Bearing Power of Piles

The usual formula for the safe bearing power of wooden piles is:

$$B = \frac{2\,W\,H}{S + 1}$$

in which

W = weight of hammer in pounds.
H = weight of fall of hammer in feet.
S = penetration in inches per blow, average of last few blows.

If reinforced concrete piles are molded before being driven, the head of the pile is usually cushioned more or less and the pile is generally much heavier in proportion to the weight of the hammer than is the case with wooden piles. It is recommended that the hammer should be at least as heavy as the pile.

If concrete piles are molded in place, measures should be taken to prevent damage to them by the driving of neighboring piles or otherwise.

Bearing Power of Soils

This subject is under investigation by a committee from the American Society of Civil Engineers. It may be some years before their final report is submitted and even that will be subject to revision from time to time, as human knowledge is extended. In the meantime the committee would submit the following preliminary table:

Material	Safe bearing power tons per sq. ft.
Quicksands and wet soils	0.1 to 1.0
Dry earth, according to depth below surface	1 to 3
Moderately dry clay, confined	2 to 4
Dry stiff clay	4 to 6
Sand confined	2 to 6
Sand compact and cemented	4 to 8
Gravel cemented	8 to 12
Rock	25 to 200

Foundations should be carried down below frost unless they are on rock and thoroughly drained. Soil that contains the roots of plants is generally compressible. Undisturbed soil is much less compressible than filing or similar soil, even though it has been in place many years. The bearing power of sand, gravel and dry clay increases rapidly with the depth below the surface of the ground. None but the smallest structures should be founded on earth filling.

The pressure of earth against abutments, wingwalls and retaining walls varies so widely with the character and condition of the earth in question, that nothing more than a few general suggestions can be given. It is hoped that the committee from the Society of Civil Engineers, which is studying the bearing power of soils, will take up this subject also. In ordinary cases where the filling is well drained its pressure will seldom be more than that of a liquid weighing 25 lbs. per cubic foot, and is frequently much less. The pressure due to land slides is often several times this amount. If the filling is clayey and is allowed to become waterlogged, its lateral pressure is greatly increased. The effect of the freezing of the filling must also be considered.

Required Waterway

The usual formula for a waterway for culverts is:

$$a = C A$$

in which

a = required area of culvert in square feet.
A = drainage area in acres.
C = a constant, depending on the length and character of the drainage area and may vary from about 0.3 to 2.0 in regions where the mean annual rainfall is about 50 ins.

Waterproofing Masonry

A comprehensive report of forty-eight pages on waterproofing masonry, the results of five years of investigation, was submitted at the recent annual meeting of the American Railway Engineering Association by the committee on masonry. The committee discusses coatings, membranes, integrals and watertight concrete construction, and include five pages of diagrams showing methods of waterproofing bridge floors of various types, arches, subways, expansion joints, etc. The following conclusions are recommended for adoption in the "Manual":

1. Watertight concrete may be obtained by proper design, reinforcing the concrete against cracks due to expansion and contraction, using the proper proportions of cement and graded aggregates to secure the filling of voids and employing proper workmanship and close supervision.

2. Membrane waterproofing, of either asphalt or pure coal-tar pitch in connection with felts and burlaps, with proper number of layers, good materials and workmanship and good working conditions, is recommended as good practice for waterproofing masonry, concrete and bridge floors.

3. Permanent and direct drainage of bridge floors is essential to secure good results in waterproofing.

4. Integral methods of waterproofing concrete have given some good results. Special care is required to proportion the concrete properly, mix thoroughly and deposit properly so as to have the void-filling compounds do the required duty; if this is neglected, the value of the compounds is lost and their waterproofing effect detroyed. Careful tests should be made to ascertain the proper proportions and effectiveness of such compounds.

Integral compounds should be used with caution, their chemical action on the concrete being ascertained as well as their effect on its strength. As a general rule, integral compounds are not recommended, since the same results as to watertightness can be obtained by adding a small percentage of cement and properly grading the aggregate.

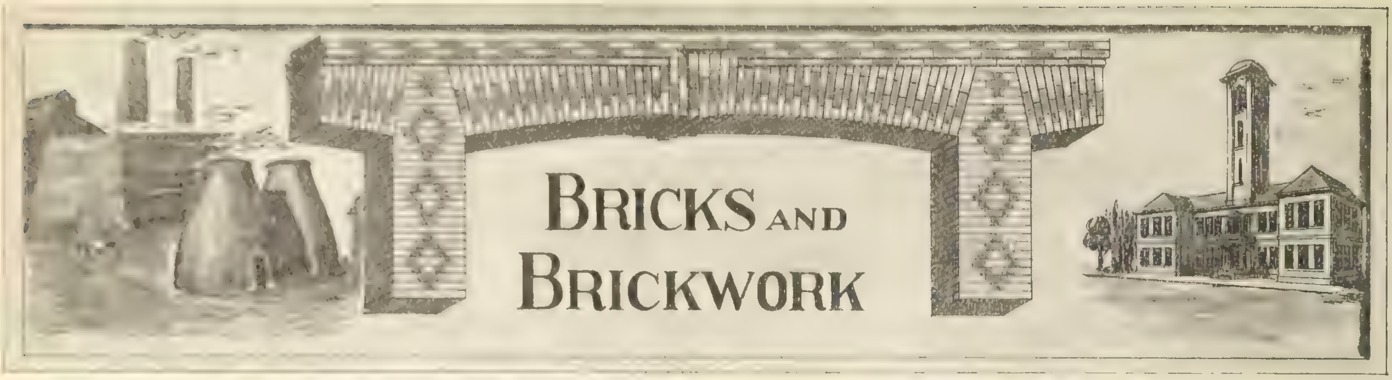
5. Surface coatings, such as cement mortar, asphalt or bitulithic mastic, if properly applied to masonry reinforced against cracks produced by settlement, expansion and contraction, may be successfully used for waterproofing arches, abutments, retaining walls, reservoirs and similar structures; for important work under high pressure of water these cannot be recommended for all conditions.

6. Surface brush coatings, such as oil paints and varnishes, are not considered reliable or lasting for waterproofing of masonry.

J. W. B. Blackman on Town Planning

Town planning was the subject of an interesting paper by J. W. B. Blackman, City Engineer of New Westminster, presented before the Vancouver Branch of the Canadian Society of Civil Engineers on March 17. Mr. Blackman showed how the science of town planning had taken hold of Canada since the passing of the Town Planning Act by Great Britain in 1909. On April 20, 1912, the Dominion Government granted to New Brunswick an Act Relating to Town Planning, while during the last session of the provincial government, at Victoria, B.C., a clause was embodied in the new Municipal Act giving cities the power, with the consent of two-thirds of the ratepayers, to pass bylaws for town planning. Quite recently Vancouver has been considering a scheme for a new civic centre. Mr. Blackman touched upon the more important points in town planning, urging particularly common-sense limitations as to the height and character of buildings. In Canada and the United States, he contended, our skyscrapers were the greatest enemy to the public health. Mr. Blackman cited the death rates of a number of the larger cities of the world and compared them with those of a number of the garden cities, and the comparison was most illuminating. The death rate at New Orleans, for instance, is 22.6 per thousand, while at Port Sunlight, in England, it is only 9.0 per thousand, and at Letchworth, England, still lower—only 4.8. The death rate at San Francisco is 20.9, at New York 19, Paris 18.2, Berlin 18.3 and at London 16.9. European countries generally are taking steps to prevent the physical deterioration of the race through lack of air, sunlight and sanitation. Australia's example in laying out the new Capital was to be commended and the example was one for Canada to contemplate. Mr. Blackman made a strong plea for diagonal streets and deplored the square block plan which had been followed in certain cities. One of the dangers in replanning a town or city lay in destroying the individuality that it possessed. The individuality of a place should be preserved and cultivated in the same way as personal individuality. This virtue of individuality, particularly noticeable in the older cities, was illustrated by lantern slides showing a number of European cities. The whole paper was copiously illustrated.

The Cooke Construction Company, the contractors engaged in the work of widening the Montreal aqueduct, a contract involving the expenditure of some two and a half million dollars, were ordered to cease operations last week by the city engineer, Mr. Janin, acting on the instructions of the controllers. The reason given is that the company in its excavation work in the rock sections had been endangering the foundations of the embankment of the aqueduct. The Cooke Construction Company had complete equipment and a large staff of men on the ground and it is regarded as certain that a series of law suits will follow the cancellation of the contract. Mr. Henry R. Lordly, the engineer-in-charge of the Lachine Canal made an independent examination of the work for the city.



BRICKS AND BRICKWORK

Bonds in Brick Work

SEVERAL of the bonds that are now employed in exterior brick work are described in an interesting article by H. D. Eberlien. He says the most common bond, in fact, almost the only one employed during a great part of the Nineteenth Century, is the running bond, in which all the courses are composed of "stretchers," that is to say, brick laid lengthwise, the only "headers" or endwise brick visible being at the window jambs, at the starting of piers and pilasters and in straight header courses at more or less frequent intervals where their use is made obligatory by the local building laws to tie the face-wall to the backing. Each course breaks joints vertically with the courses immediately above and below. Running bond is perhaps the simplest and certainly the least interesting and artistic way of laying brick and has little to commend it except considerations of economy.

The Flemish bond, in which every course consists of alternate headers and stretchers is, after the running bond, the one we most commonly meet with, having been generally used in our brick buildings of Colonial date, in which the black header and red stretcher effect is so often noticeable. Flemish bond is constructionally honest, artistics and satisfying, and its almost universal employment in modern building of Colonial style cannot be too strongly commended.

The double-stretcher Flemish bond, as its name denotes, consists of two stretchers together, followed by a single header in all courses, the headers being laid above the joints between the two stretchers in the course next below. It is coming more and more into vogue in America and has been used in some of our largest buildings with signal success.

For the vertical joints between the contiguous stretchers mortar colored to exactly match the brick is often used, thus making a blind joint and giving the effect of one double-length stretcher. The use of double-stretcher Flemish bond sets a big, broad scale and can be employed to advantage in large wall surfaces, particularly where it is desired to take oft somewhat from the appearance of height, as the strongly marked horizontal lines have that effect. This feature can be further emphasized by slightly increasing the thickness of the horizontal mortar joints.

English bond and Dutch cross bond, like both the single-stretcher and double-stretcher Flemish bond, are replete with artistic feeling and deserve to be far more widely known and used than they now are in America. Not only are they essentially artistic but they are strong and honest in structure. Both English bond and Dutch cross bond have alternate courses, the one wholly of stretchers and the next wholly of headers; but in the English bond the stretchers of the first and fifth courses break joints with the stretchers and of the third and seventh courses respectively and thus throughout, giving a diagonally diapered appearance if the mortar joints and the hue of the brick be judiciously contrasted.

The bonds mentioned are the most usual kinds, but one also meets with special adaptations of recognized types; it is, however, quite sufficient for general purposes to remember the five enumerated. In fact, many people, who are supposed to have some knowledge of such matters, have difficulty in keeping the differences clearly in mind and generally fall down in trying to describe them.

Brick Roads Without Permanent Curbs or Edging

IN a paper presented at the twenty-ninth annual meeting of the Illinois Society of Engineers and Surveyors by Mr. W. T. Blackburn, Paris, Ill., the construction of two brick roads built without permanent curbs or edging was described as follows: I have in mind a brick country road 9 feet in width that has been in constant service since 1899 (14 years). The roadway was constructed according to what is known as the two-course method and was composed of brick on edge for wearing surface, resting on a cushion of sand, supported by a number 2 paving block foundation. Two-inch boards were placed along both edges level with the finished brick surface to act as an edging. The earth was graded up level with the surface of the pavement. The boards are almost all gone, either having decayed or having been lifted by frost and removed. This roadway is in excellent condition and has demonstrated that a country road can be successfully built in this manner.

An experimental section of brick road about 300 feet long has been recently constructed to connect the above described road with another brick pavement. This section is provided with a 4-in. concrete foundation made smooth by the use of a template drawn over boards set to grade along the sides of the foundation. On the foundation was placed a well-compacted sand cushion 1½ inches in depth, and on this was placed a brick surface made smooth by rolling. Care was exercised that the joints were left open and they were afterwards filled with a cement filler made of 1 part cement to 1 part fine sharp sand. The precautions were taken to place the fractured ends of the bats away from the edge of the pavement, and to use nothing smaller than half brick at the edges, leaving the edge of the pavement finished with the perfect ends of blocks. The boards were then removed and the earth tamped along the edges of the pavement.

This experiment bids fair to demonstrate the practicability of building brick roads without the added expense of an edging. This pavement was built 9 ft. in width and should necessity require a greater width a 3 ft. crushed stone shoulder can be placed on each side.

Design and Construction of New Veterinary College, Toronto

TORONTO enjoys the distinction of possessing a new Veterinary College which has two features of outstanding interest to the building trade. The need of suitable accommodation for the advancement of Veterinary Science has been realized for many years by the Ontario Government, and the new structure, which is located on the west side of University Avenue, has been designed to fulfil the requirements of the veterinary branch in every respect. The building is claimed to be the largest of its kind on the American continent, having a frontage on University Avenue of 134 ft., on Simcoe Street of 49 ft., and on Anderson Street of 46 ft., its height from ground floor to cupola roof being 82 ft. The structure covers an area of 10,000 ft., and besides being the largest of its kind from the structural standpoint, it also possesses the largest anatomical laboratory on the continent—42 ft. by 104 ft.

The building is five storeys in height including the basement. The foundations are of concrete and the building of skeleton steel construction, being fireproof throughout. The main spans are carried on girders, and the design in this and other respects is similar to that of most buildings of the kind. The basement and first storey are of grey freestone, and the substructure is of Don Valley stock brick, with cut stone cornices and dressings.

The main entrance to the basement is from Simcoe Street, leading into an extensive stable to be used as an infirmary for horses, with an operating room adjoining. This latter will embody all the most modern features and equipment to be found in buildings of the kind. The caretaker's quarters are also located in the basement and these have an entrance from Anderson Street. The main entrance to the first floor is in the centre of the facade on University Avenue, through a stone porch with rusticated columns. The business offices and the Principal's rooms are located to the left of the main entrance, the remaining space being taken up with offices, lavatories, classrooms and storage rooms. The second floor contains a large laboratory, a classroom, faculty room and an assembly hall capable of accommodating five hundred students. The third floor is divided into a laboratory, a classroom, a library and a museum. The anatomical laboratory is located on the fourth or upper floor, and there are in addition an incinerator room, toilet and students' recreation and resting rooms. An elevator of the

New Veterinary College, Toronto.—An attractive building which exemplifies the possibilities of brick harmonized with stone in the exterior

This Persian type extends from the basement to the anatomical laboratory.

In every respect the building is thoroughly up-to-date, ample provision being made for toilet and other conveniences. Each of the four laboratories is designed to accommodate a hundred and twenty students. A low-pressure steam heating plant is installed throughout, the boiler house, containing two tubular steam boilers supplied by the Berg Machinery Company, being located in the basement. Each of the classrooms situate in the basement, first and second floors, will accommodate a hundred and ninety students. It is expected that the college will be completed for the reception of students before the end of the present year.

The building which is electrically lighted throughout, was designed, and plans prepared by Mr. F. R. Heakes, Provincial Architect, after a visit had been made in conjunction with Dr. E. A. A. Grange, Principal, Ontario Veterinary College, to a number of similar institutions throughout the American continent. The building involves an outlay of about $250,000. All the red stock brick used in the building—including perforated tile brick with which all the exterior walls and partitions are lined—to the number of about 1,500,000, were supplied by the Don Valley Brick Works.

The contract for the excavation for foundations was entrusted to Messrs. Thomson Brothers. Mr. Edward Gearing carried out the contract for the stone and brick work and fireproofing. The other contractors were:—Carpenter work, Messrs. T. V. Gearing and Company; steel work, Dominion Bridge Company; brick, Don Valley Brick Works; concrete, Messrs. A. Gardner and Company; heating, plumbing and ventilating, Messrs. Purdy & Mansell, Limited; plastering, Mr. A. D. Grant; electric lighting, Messrs. Bennett & Wright; exterior galvanized iron, Messrs. Douglas Brothers; painting and glazing, Mr. James O'Hearn; metal, frames and sash work, Messrs. A. B. Ormsby Company, Limited. The stable fittings were supplied by the Tisdale Iron Stable Fittings Company, Toronto.

Profit or Loss with the Steam Shovel*

An Analysis of the Various Elements which Produce Efficiency in Excavation Work and a Study of their Proper Co-ordination

THE biggest thing in construction machinery is the steam shovel. Its capacity for results is so large that even most men engaged in operating steam-shovel plants do not comprehend its profit-yielding possibilities. Ranging from the little number 0 revolving shovel, for cellar excavating, to the mammoth 250-ton stripping shovels of the Kansas coalfield, its range of usefulness almost passes belief.

The monster 110-ton shovels of the Panama Canal and the 95-ton shovels for heavy railroad construction are marvels of power, mobility and effectiveness, while the 60-ton and 70-ton standard shovels for general construction are, beyond question, the most useful machines with which modern general construction is equipped. The vital and ever-new problem of getting maximum results at minimum cost is employing the scheming minds of every owner, superintendent and foreman engaged in steam-shovel work.

Maintaining Maximum Output

As a general statement it may be said that it is not what a shovel will dig but what can be taken away from it that limits its output. It is common knowledge that a 70-ton shovel with 2½-yd. dipper will dig, if operated continuously, at the rate of 3,000 cu. yds. in ten hours. How often this rate is attained for even one day, to say nothing of twenty-six consecutive working days, is such an idle question, apparently, as to bring the smile of indulgence to the face of the ordinary steam-shovel man.

If this average be possible—and it is possible in the same sense that it is possible for the expert shot to make 100 per cent. in target practice—how vital and valuable, then, is the study and application of the means of its accomplishment! Some of us are prone to idealize, but to the average man perfection or near perfection is so remote as to lose its desirability.

If a shovel capable normally of delivering 3,000 yd. daily at 33 1-3 cents contract price per yard, or $1,000 daily return only returns $333 daily, the owner may well "sit up and take notice" when he is assured of the certainty of correcting it. The most general use for steam shovels is on heavy railroad construction, where the quantities of material to be moved are so large as to justify heavy expenditures for the attainment of low-unit costs, and of such it is the purpose of this article to speak.

Contract prices for excavation are usually based on the classification of the material to be excavated, so that in a general way it may be assumed that the same degree of operating efficiency that will return $1,000 daily in earth excavation will return about the same, plus additional expense for drilling, explosives, etc., in loose rock and solid rock. Hence the degree of operating efficiency shows practically the same proportional results in all classes of materials.

Three Vital Elements

There are three vital elements in steam-shovel operation: (1) The skill of the operating crew; (2) the upkeep and maintenance of the machinery, and (3) the provision for transporting the output. Under these three heads are numerous subheads, like so many links in a chain, the weakness or inefficiency or insufficiency of any one of which reduces the efficiency of the whole to its level.

The average labor, fuel, and oil expense of operating a standard shovel, not counting haulage, etc., or upkeep, may be assumed to be $40 daily, working under ordinary conditions and supervision. If the shovel digs 1,000 yd., the cost is 4 cents per yard. If it digs 3,000 yd., the cost is 1 1-3 cents per yard. But suppose that by doubling every item of expense either by increased wages for better men or larger crews, etc., the maximum of 3,000 yd. could be maintained. The cost per yard, then, would be only 2 2-3 cents, or still a saving of 33 1-3 per cent. over the cost of the 1,000-yd. output. How many shovel owners realize and put this into practice?

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* By P. S. Fitzgerald in the Engineering Record.

Supposing, again, that the upkeep, repairs, new parts, etc., including half of the master mechanic's and blacksmith's expense, amounted in round numbers to $20 daily and that it was necessary to treble this to maintain the 3,000-yd. schedule; the unit cost would still be no larger.

This brings us to the transportation problem—the "pons asinorum" of the average operator. Assume only usual or typical conditions—narrow-gage equipment, 4-yd. side-dump cars, and 10-ton dinkeys. How many operators use sufficient trains to keep one constantly ready at the shovel? How many lay their tracks to gradients that will permit safe and continuous operation? How many provide run-around tracks in the cut so as to have one train ready at the shovel on the second the loaded train departs? How many keep surplus—sometimes idle (though usually unnecessarily so)—labor ready to throw track, extend track, back the shovel, and do the many things that cause commonplace delays at the shovel?

Take a typical case. Assume a long haul—with three trains, dinkeys and crews, fuel, water supply, track gang, trestle gang, dump gang, etc. The variable labor-expense items due to more or fewer trains are train crews, fuel, water, track gang and dump gang. It is seldom necessary to add more than one train to "take up the slack" in the ordinary haulage system. Hence, with a daily cost of $40, the unit cost of 1,000 yd. will be 4 cents, while with an increase to $60 for all items the 3,000-yd. output will cost 2 cents per yard—or a saving of 50 per cent.

Thus by increasing the efficiency expense all around $100 daily—or from $100 to $200—the actual unit cost is decreased from 10 to 6 2-3 cents, or an additional profit of 3 1-3 cents per yard, which for 200 work days on the 3,000-yd. schedule will amount to $20,000—sufficient to purchase outright an ordinary standard steam-shovel plant and have enough left to carry one month's pay-roll.

This, however, is the lesser of the two distinct profits to be gained by efficiency. If the contract price is 33 1-3 cents and the entire cost price, including interest, insurance, depreciation, temporary trestles, small-tool repairs, damage suits, overhead expense and the cost of miscellaneous items incident to steam-shovel work, is, in the 1,000-yd. case, 23 1-3 cents and in the 3,000-yd. case 20 cents, the profit on 26,000 yd. per month is $2,600 and on the 78,000 yd. per month $10,400, or four times as much. Not alone is the money a profit, but the reputation for prompt, efficient, successful work thus gained is a business asset that can hardly be reckoned in dollars. While the figures given are only illustrative, they surely serve to put in the spotlight that modern word for magic—efficiency.

Increasing Returns

The unthinking or overworked man is too prone to believe that in reducing expense lie profits. Never was theory so fallacious where results are measured in such large figures as in steam-shovel work. Additional expense for efficiency seldom outruns the gain, and never where brains, prudence and clear thinking are exercised. Of course, it is not intended to assert that by adding one train to three the carrying capacity will be trebled—but the idea is to provide ample transportation facilities so as not to delay the shovel at the maximum output.

It is the co-ordination of all the elements of the work that produces efficiency, and the principle here advocated is that it is the acme of intelligent economy to spare no expense, however, seemingly extravagant, to bring about perfect co-ordination. For instance, many owners protest at more than four pit men, when as a matter of fact six would mean often 10 per cent. gain in output; 100 yd. gain at 33 1-3 cents would seem a pretty handsome profit for an extra outlay of $4. For a shovel runner $200 per month seems high, but extra skill often adds 25 per cent. to the shovel's output, or 6,000 yd. monthly at 33 1-3 cents.

Many shovel owners scoff at such ideas and say there is nothing in them, but they seldom occupy high seats among the successful. Merely to spend money or pay excessive wages to keep idle or useless men is not the basis of this efficiency system, but not to withhold these things, when they are necessary and desirable, is the keynote. Co-ordination, ample facilities, brains, and everlastingly hitting the ball at maximum speed are prime requisites, and combined they spell efficiency and profits.

LETTERS

Editor Contract Record:

Will you kindly inform me through the medium of your valuable journal what amount constitutes an average annual expenditure on engineering works for a municipality with a population of about 20,000, and what is the ratio of staff expenses. If any of your readers can give me a few facts out of their experience it will be helpful to me and of interest to my council.

Yours truly,
City Engineer.

Recognition of Engineers

Halifax, N.S., March [illegible]

Editor Contract Record:

The subject of engineering organization discussed editorially in your issue of March 4 has been brought up at the meetings of the Nova Scotia Society of Engineers, and we realize the importance of it, but the difficulty of starting such a movement seems to be the stumbling block. I, myself, have no hesitation in opposing the idea of close corporations which you can put forward as a means towards this end; at the same time, I believe that something should be done to recognize engineers, who, by experience or technical training, should be in possession of a certain standing which is now accorded to other professions.

Yours faithfully,
A. R. MacCleave*

The Organization of Engineering Interests

Editor Contract Record:

After a careful perusal of the editorial article on the above topic published in the Contract Re[illegible] am inclined to express hearty agreement with the principle, viz., the desirability of better organization and the co-ordination of the various branches of the engineering profession. At the same time I cannot overlook the fact that the field has become so vast that it is impossible for any one man to keep in touch with the innumerable subjects offered, to say nothing of having any understanding of them. Meetings that would include the engineers of all branches would by their mere ponderosity crush or defeat their purpose. This is exemplified in a minor degree in the American Association for the Advancement of Science, wherein so much is not comprehended. The suggestion looking to a wholesale exchange of publications is unpracticable—and in any case too costly, as those who have attempted it in the surveying and civil engineering professions have found out. The details do not call for elaboration. As for keeping au courant of general engineering events, there is available to the profession the Engineering Index published by the Engineering Magazine Company. This covers eight branches of engineering and serves a most useful purpose. It is too true that live engineering societies exist only in the large cities; in the smaller cities it is a case of mere existence, or vegetation, and the only life is infused by one or two enthusiasts who, rain and sunshine, stick to their self-imposed, thankless task of securing for each meeting interesting material from competent men.

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* [illegible] Halifax, N.S. [illegible] of Engineers.

A panacea for lack of interest in society work has yet to be discovered. Local enterprise and local conditions govern. If the members are dead the society is dead; if the members are alive there is no reason why the society, also, should not be alive.

Yours very truly,
E. W. Hubbell.*

The Value of Architectural Competitions

Toronto, March 25, 1914.

Editor Contract Record:

I quite agree with the spirit of the editorial article relating to architectural competitions published in your issue of March 18. Undoubtedly, competitions, as they are now conducted in Canada, are very unsatisfactory. One must not overlook the fact, however, that the greater portion of public and semi-public work has to be competed for and that under existing conditions Canadian architects are forced to go into competitions. I am fully convinced that if the money expended on competitions were employed in engaging a reputable architect in whom the owners had confidence the results would be much better. The architect should make exhaustive studies and devote some time to visiting other buildings of a similar character. He should have repeated consultations with the prospective owner and thoroughly familiarize himself with his requirements.

It is well known that certain architects can do certain kinds of work to advantage. For instance, it is most likely that an architect whose practice is confined largely to domestic work would be in a position to handle an important public building. His training and experience are entirely contrary to the spirit of the larger problem.

If a man is seriously ill, he certainly does not advertise for competition among doctors to find out who is going to give him treatment and to see what treatment he would prefer to have; he makes enquiries and goes to the best man he can find.

The idea is sometimes advanced that by means of competitions some heaven-born talent is brought to light. This contention is not borne out by experience.

It will usually be found that work of an important character does not come to any architect, either by competition or otherwise, until he is competent to undertake that work. The younger architects will have to fight their way up, just as their elders have done.

If competitions are to be held, I think the proper method of conducting them is for the committee in charge of the competition to select four or five architects of standing in the community, any one of whom they would be satisfied to have erect their building. These architects should be amply paid for their services.

While on this subject, it has always seemed to me that those responsible for the programme of requirements make two mistakes. In the first place they usually ask for too many drawings. What is the sense of asking an architect, in a competitive set of drawings, to submit a basement plan or a roof plan. They surely have no bearing on the parti, but only make additional work for the architect. Secondly, they so word the programme and give such definite instructions as to preclude any variation of solution, thereby defeating one of the primary objects of the competition.

Very truly yours,
John M. Lyle.

Should the Engineering Profession be a Closed Corporation?

Calgary, Alta., March 19, 1914

Editor Contract Record:

I have read with much interest the editorial, entitled, "The Organization of Engineering," in your issue of March 4. I have given this subject considerable thought recently and have almost come to the conclusion that the engineering profession should seek legislation to form a closed corporation. Being young in the profession I hesitate to express such a view, but I believe that this is the opinion of a very large number of engineers. Looking at it first from the point of view of the general public: should there not be some means by which any person can distinguish between the qualified and the unqualified engineer? There is legislation to prevent the untrained and incompetent from practising medicine, surgery, dentistry and law, and we all know that a doctor, dentist or lawyer who obtains a license is at least competent and trained for ordinary professional responsibility. Even the land surveyor—quite properly, I think—has to obtain a license. If it is necessary to protect against the unqualified in other professions—and we all know the advantages of that protection—is it not equally desirable to protect against the unqualified engineer? Many of the blunders and failures attributed to the engineering profession are really the work of some pseudo-engineer, who has, as you say, by push and effrontery, bustle and bluff, secured the work. Under present conditions the ordinary person cannot distinguish between the qualified and the unqualified engineer, and as a result, many of the fees are diverted from the legitimate pockets. Of course it is nobler to have gained the distinction of being a great engineer in an open race, but the few who gain that distinction might well forfeit a little of the glory for the sake of the very many who do not gain distinction.

I quite agree with the President of the Illinois Society of Engineers and Surveyors who recently stated: "This is the day of organization; individual effort fails. In business, consolidation alone survives. If engineers are to progress and to retain their rightful sphere, they must do so through organization."

We must become strongly organized to guard and advance our interests in legislation and in public relations.

There should only be one organization for the whole Dominion—not a separate organization for each province or each branch of engineering. The civil, mining, mechanical and electrical engineers are usually educated in the same institution and after all they use the same fundamental ideas and general principles in their work. There is, therefore, no reason why they should not work shoulder to shoulder in one society for the general welfare of the profession. Instead of creating new societies the existing ones should be broadened to meet the requirements, and, if possible, amalgamations should be effected. The suggestion that the different societies should exchange "Proceedings" is a very good one, but I would go further and suggest that joint meetings would be much more effective, provided the papers and addresses were not too technical, so that everyone in the audience could understand and take part in the discussion. The reading of purely technical papers is almost a waste of time in a general meeting, as it is impossible for the audience to grasp the full meaning or arguments by listening to a paper read hurriedly. The publication of the highly technical papers is the proper means of disseminating them. Addresses on general subjects are much more interesting for general meetings and do a great deal towards broadening the engineer, which is what he requires.

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*Secretary of the Association of Dominion Land Surveyors.

I think, therefore, that the engineering societies should all work together and the ideal condition would be reached if there were only one society divided into departments for each branch of engineering. One strong and truly representative organization can accomplish a great deal more than several mutual admiration societies.

Incidentally I may add that much can be done to advance the interests of the profession by the proper kind of publicity work. Everyone has heard the chronic complaint by engineers that their work is not properly appreciated and understood by the public. It is idle to dream that through some fortuitious combination of circumstances the public will suddenly awaken to find what important service the engineering profession is rendering. The work and accomplishments of the profession, and even individual engineers, will be given the proper place in the press, if the profession will but do itself justice by furnishing the data.

Yours truly,
P. M. Sauder*

"Engineers Must be Prepared for Hard Knocks"

Victoria, B.C., March 25, 1914.

Editor Contract Record:

In respect of the editorial, "The Organization of Engineering Interests," published in your issue of March 4, I beg to offer you my views, which are the outcome of twenty-six years' experience—obtained mostly in Western Canada.

The organization of "a controlling body or central committee" would be dependent upon other factors, which must be first considered before arriving at the end in view, and the personal equation would appear to be the starting point in any scheme for re-organization. It has always appealed to me that the present lack of cohesion and the weakness of the engineering profession in Canada has been attributable not so much to lack of organization as to (1) the apathy and lack of pride in their profession amongst our individual members of the "rank and file"; (2) the system under which our governing Council is nominated and elected, and (3) the preponderance of University methods and theories in handling the business of the Society.

With regard to No. 1, I think you will agree that in the various branches of all societies, whether professional, benevolent or otherwise, the real work of keeping float and forging ahead is invariably found to be shouldered on to a few of the more energetic members, and the removal of such members often causes a moribund condition to develop, as I have frequently noted in various towns or cities.

The only remedy for this phase of the situation would appear to be a persistent appeal amongst individual members for a higher sense of [illegible] and to [illegible] each member's pride in the work to be done for the profession by each individual unit. As an example I will quote an incident brought to my notice recently.

A corporate member of the Society who attended the annual meeting of the Canadian Society of Civil Engineers in Montreal this year, in giving his views of the proceedings, stated that he felt strongly inclined to criticize certain statements made by other members in the discussions but refrained because there were so many members present who were his seniors in age and standing. This member failed lamentably in his duty to himself and his Society through an entirely misplaced veneration for the fetish of "age and reputation"—and his case is doubtless that of many others.

With regard to No. 2, the present method in vogue of electing a nominating committee and the selection of officers by them has tended to develop autocratic rather than democratic government in the Society. As a result we have a Council containing a majority of men usually eminent in the profession, but too busy to get in touch with the human element of the membership at large, and practically acting as "sleeping partners" in the firm with the Secretary as "working partner."

The position of Secretary, being, in my opinion the keynote of the structure, should be held by a member who would devote his entire time to the work at an adequate salary, and his selection should be governed by a wide experience on practical engineering work from the bottom rung of the ladder upwards, involving the handling of men under various conditions and in different localities—in short a man thoroughly versed in human nature, and that knowledge not confined to any one province or district.

Taking up No. 3 there appears to be a growing idea in the public mind (and also to some extent in the professional mind) that a college course turns out a finished engineer, regardless of practical experience. As a matter of fact a college course cannot take the place of experience, but gives the recipient a much better opportunity to become a successful engineer by reason of the study wherewith he has charged his mental battery.

The present system of election to the Society is also defective, as an unmarked ballot counts for the affirmative vote, which renders it unnecessary for those balloting to even read through the ballot. If the word "aye" or "nay" had to be written opposite each name to render a ballot effective, it would at least put each Councillor under the obligation of turning over the pages before mailing to headquarters.

I fear my "views" have run into overmuch space. I can only say in conclusion that we must break loose from the "mutual admiration attitude" mentioned by Mr. Shenton in his address upon which your editorial was based. This attitude we must be prepared to take and give the hard knocks which always accompany genuine reformation.

Yours truly,
R. W. Macintyre, M.Can.Soc.C.E.

Reinforcement of Concrete Floor

Editor Contract Record:

Will one of your readers kindly give a detailed method of finding the reinforcing necessary in a six-inch concrete floor, designed according to the Ontario Government Specifications for Highway Bridges 1911. Span of slab to be three feet.

A Reader

Surveyors have been at work for some time in the interests of the Canadian Northern Railway Company, deciding upon possible route for the construction of an electric road from Guelph through Hespeler, Preston, Galt and Brantford. A similar survey was made a year ago from Guelph through [illegible] Mosboro' and Breslau to Berlin.

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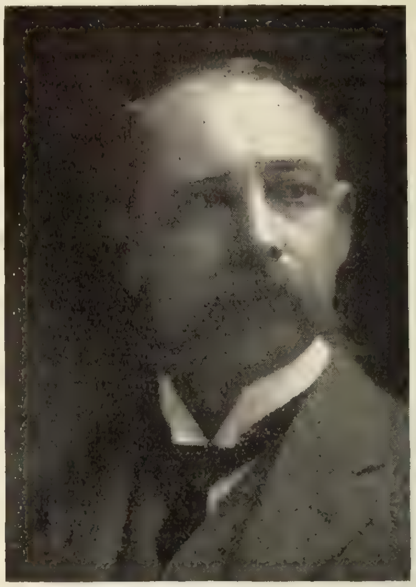
*Secretary Treasurer Calgary Branch, Canadian Society of Civil Engineers.

Col. W. M. Davis.

Messrs. Davis and Leslie, in consulting practice at Vancouver, who were recently appointed engineers of the North Fraser Harbor Commission.



Mr. R. F. Leslie, M. Inst. C. E.

Personal Mention

Mr. George Morgan Kennedy, a Toronto contractor, who died on February 27, left estate valued at $23,954.

Mr. J. H. Haffa has opened an office for the practice of architecture in the Peterkin Building, Bay Street, Toronto.

Mr. James Sheppard, of Queenston, has received an appointment as superintendent of good roads in Welland County.

Mr. Ward Carlee has been appointed City Engineer of Swift Current, Sask., in succession to Mr. Geo. D. Mackie, who is now city engineer of Moose Jaw.

The candidates for Controller of the city of Montreal include Mr. Percival St. George, consulting engineer and former city surveyor, and Mr. A. V. Roy, C.E.

Mr. Frank Drayton, president of the Amateur Baseball League, has been appointed secretary-treasurer of the Edmonton Builders' Exchange, succeeding Mr. John McPherson.

Mr. Thos. W. Lamb, architect, New York City, has removed his Canadian office from Loew's Theatre, Toronto, to the Stair Building and has placed Mr. A. H. Harding in charge.

Messrs. S. B. Coon & Son, architects, Toronto, have removed from the Temple Building, to more commodious quarters in the new Ryrie Building, at the corner of Yonge and Shuter streets.

Mr. A. M. Jeffers and Mr. W. A. Wheeler have been appointed architects of Edmonton under the city engineer's department. Mr. Jeffers' salary is fixed at $275 a month and Mr. Wheeler's at $160.

Mr. L. G. Stuart, of the Toronto Roadways Department, is arranging for an extended trip through Europe with the object of studying transportation facilities in the principal cities, and European municipal methods generally.

Sir Thos. Shaughnessy, president of the C. P. R., will be the guest of the city at a banquet on the occasion of the opening in May of the Hotel Pallisser, which is in course of completion for the Canadian Pacific Railway at Calgary.

Messrs. Davis & Leslie, consulting engineers Vancouver, have been appointed by the North Fraser Harbor Commissioners as their engineers, and will have charge of the preparation of places for the future development of the North Arm of the Fraser River, which it is anticipated will provide for a harbor scheme of an important nature. The North Arm of the Fraser River diverges from the South Arm at New Westminster, and flows in a westerly direction, entering the Gulf of Georgia in the vicinity of Point Grey. It forms, therefore, the southern boundary of what is known as Greater Vancouver, its approximate distance from the centre of the present city of Vancouver being about five and a half miles. The Harbor Commission's jurisdiction covers the whole of the North Arm from the western boundary of New Westminster to Point Grey, a distance of about 17 miles and also includes the adjacent waters of the Gulf of Georgia over what is known as Sturgeon Bank. Messrs. Davis & Leslie are the appointed representatives for British Columbia of the well-known English engineering firm, Sir Douglas Fox and Partners, and are themselves both highly qualified engineers, with practical experience covering a period of over thirty years. Colonel W. M. Davis, who is a member of the Canadian Society of Civil Engineers, graduated from the Royal Military College at Kingston in 1880 and has been associated with many important undertakings both in Eastern Canada and British Columbia. Among other works in Ontario he was responsible for the Berlin sewage disposal plant. He occupied the office of City Engineer of Prince Rupert from 1910 until 1912 and for the last two years has been in consulting practice in Vancouver. Mr. R. F. Leslie, commenced his practical engineering work in 1881, as an articled pupil in the service of the Great Western Railway, England, and has had wide and continuous engineering experience in various parts of the world ever since, specializing in railway and harbor work, both in England and abroad. For many years he held responsible positions on one of the largest systems in India, and as a senior divisional engineer had charge of much important construction. During the last nine years he has been engaged in railway and harbor work in Canada. Mr. Leslie became an Associate Member of the Institution of Civil Engineers in 1891 and was transferred to the class of Member in 1901. He is also a member of the Canadian Society.

Col. Pilkington, chairman of the directors of the Pilkington Brothers, Limited, St. Helens, Eng., and Toronto, Ont., died on the 15th ult. at Cannes. The late Col. Pilkington had been actively identified with the firm for fifty-six years.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

A factory has been erected in St. John, N.B., for the manufacture of aerated waters.

The city of Quebec is having plans prepared for a fire station to involve an expenditure of $135,000. Mr. W. D. Baillarge is the architect.

Dominion charter has been granted the Interprovincial Brick Company of Canada, Limited, Montreal, to manufacture ceramic ware of all kinds.

The ratepayers of St. Catharines, Ont., will soon be asked to vote on a bylaw for the construction of a new High Level bridge which is projected for the city.

The parish of St. Roch, Quebec, P.Q., are contemplating the erection of a new church estimated to cost $250,000. Tenders will be called shortly by the architects, Messrs. Talbot & Dionne.

It is stated that Mr. Albert I. Jacobs, of Brantford, is negotiating for the purchase of the old Defiance Iron Works at Chatham, and that he will establish a factory for the manufacture of farm machinery.

St. Lambert, P.Q., is undertaking extensions to the waterworks and sewerage systems at a cost of $480,000. The work is scheduled to start a month from date. The Town Engineer is Mr. E. Drinkwater.

Welland County Council has decided to build thirty-four miles of good roads this year by contract, in addition to the mileage constructed by the three county outfits, which it is estimated will total twenty miles.

The third of six scows was launched recently from the yards of the Polson Iron Works for the Montreal Harbor Commission. It is 144 feet long, 31 feet wide and has a capacity of 500 cubic yards, with seven pockets. The six scows will cost $140,000.

Messrs. F. J. Mark Construction Company, of Birmingham, Alabama, are the general contractors for a factory building estimated to cost $250,000, to be erected in Toronto for the Ford Motor Company of Canada. The architects are Messrs. John Graham & Company, Detroit, Mich.

One hundred and fifty thousand dollars is the estimated cost of a Roman Catholic cathedral at Prince Albert, Sask., for which tenders will be received until the thirteenth of this month. The building will be of sand and brick construction. Mr. A. Graham-Creighton, of Prince Albert, is the architect.

With the object of urging important changes in the plumbing bylaw of Hamilton a deputation waited on the Board of Control recently and suggested a number of alterations and additions so as to bring plumbing up to the standard of other cities. The Board promised to deal with the matter at an early date.

A new school is to be erected at Walkerville, Ont., at a cost of $60,000. It is designed for a 17-roomed school, but only the centre portion of nine rooms will be erected at the present time. This will be 62 ft. by 102 ft. and will consist of two storeys and basement. It will be of fireproof construction, solid brick and tile lined brick walls; the floor being hollow tile and reinforced concrete. The exterior will be faced with pressed brick and trimmed with Bedford limestone. Plans were drawn and specifications prepared by Messrs. Kinsey & Chapman, architects and engineers.

Two public schools at a cost of about $200,000 each are to be erected by the Board of Education on a site north of Danforth Avenue, Toronto, and a technical school for the east end at an outlay of about $400,000 will be erected north of Danforth Avenue. The sites, buildings and equipment will aggregate about $1,000,000.

The announcement is made that in addition to the factory at Coldbrook, N.B., where the Ford Automobile Company will this year begin turning out cars, the recently organized Dominion Motor Car Company will take steps to erect a plant. It is likely the company will make St. John their manufacturing and distributing centre for Canada.

From the annual report of the city engineer of St. John, N.B., we learn that the total length of pipe lines of the city's waterworks system is 83.8 miles, while the sewerage length is 43.1 miles. In the city 9,647 lineal feet of pipe were replaced at a cost of $21,861 and 7,019 feet laid at a cost of $20,827. New sewer pipe to the extent of 8,384 feet was laid.

The Canadian Stewart Company have a large quantity of machinery and piles on the ground ready to commence work on the Toronto harbor improvements. All water lots east of Woodbine Avenue which are to be used in the harbor improvement plan and for which an expropriation by-law was passed by the City Council recently have been taken over by the city.

The negotiations between Messrs. T. McAvity & Sons, Limited, and the city council of St. John, N.B., with reference to the establishment by this company of an iron and brass manufacturing plant involving an ultimate expenditure of two million dollars, have proceeded so satisfactorily that the company expect to be able to begin work on the site of their new plant in the spring.

A new industry which promises to become one of the leading in the Maritime Provinces, has recently been started at Newcastle, N.B., by Mr. E. G. Hedman, of Rosebank. The business is the manufacture of weighing scales for which Mr. Hedman holds patents in fourteen countries. Mr. Hedman intends to form a company and erect a large factory, and the new works are expected to be located at Newcastle.

Plans prepared by Mr. J. P. Haynes, architect, Toronto, have been accepted for the erection this summer of a new parochial building to be known as Congress Hall, at the corner of Dorchester and St. Alexander streets, Montreal. Tenders are now being invited for the building, which will be four storeys and basement, of fireproof construction, with steel columns and girders. Montreal limestone will be the material largely used in the structure.

An investigation conducted by Judge Denton concerning the recent fire in the Woodbine Hotel, Toronto, and its relation to the city architect's department revealed the fact that the building was not constructed in accordance with the building by-law, which requires that all hotels more than thirty-five feet high should be of fireproof construction; that the only fire escape on the annex could be reached only through a bedroom, the door of which would be normally locked, and that the building permit did not specify a fireproof building and therefore did not comply with the building bylaw.

Mr. W. S. Calvert, ex-M.P., of Ottawa, a member of the syndicate of British and Canadian capitalists interested in the development of the oil shales in Albert County, visited St. John, N.B., recently. In an interview he said the details of development could not be given out as yet, but it looked as if the plans of the syndicate would be of great importance to St. John, as oil and gas could be brought to the city by pipe lines. Mr. Calvert added that a definite announcement regarding the development of the property would be made in a short time. Having spent two weeks on the property in company with expert engineers he is convinced of the great value of the deposits.

An important announcement in connection with the Government good roads project was made recently by Hon. Mr. MacKenzie at Sherbrooke, Que. He stated that contracts for the Sherbrooke highway will be let shortly and that the road will be finished this summer. The next road to be undertaken will be a highway from Quebec to the Intercolonial boundary to connect with the new English system at Jackman, Me. Subsequently the government would commence the construction of the Quebec to Montreal road, via Richmond. The work of all these projects will be carried on as speedily as possible and the roads will be equal to any on the continent. Wherever possible, wooden culverts and bridges will be replaced by iron, steel and cement. The government, he stated, was bound in honor to carry through its good roads policy and was anxious to help all municipalities in need of aid.

WESTERN CANADA

Robertson Presbyterian College Board, Edmonton, are raising funds for the erection of a new college building estimated to cost $150,000.

Messrs. Doyle, Thomas & Christiansen, who have the contract for the Allan Gray school in Edmonton, have started work on the building.

Regina ratepayers have approved a bylaw to raise $170,000 for the construction of storm water sewers. Mr. F. McArthur is the city engineer.

At Calgary, Alta., tenders are about to be called for a six-storey Industrial Housing building, estimated to cost $250,000. Mr. A. Pirie is the architect.

Members of the school board of Edmonton are planning to erect this year an Administration Building, to cost $250,000. The structure will be located on College Avenue.

Port Arthur is planning the erection of a new Roman Catholic Church, estimated to cost $140,000. The Bishop of the district is the Right Rev. D. J. Scollard, of North Bay.

Extensions to the electric lighting and power system of Regina, Sask., are to be made at a cost of $160,000. Mr. E. W. Ball is superintendent of the lighting and power department.

Mr. N. A. McIvor, building inspector of Edmonton, reports that this season gives every promise of being characterized by the erection of more substantial buildings than in [illegible].

Mr. Jeffers, City Architect, is preparing plans for the erection of a municipally-owned swimming bath in Edmonton. The pool will be 56 by 150 feet, with a maximum depth of 8.6 feet.

Twenty-five applications were received recently by the city council of Kamloops, B.C., for the position of City Engineer. The final choice lay between Messrs. F. W. Anderson, E. Kingwell and C. Collingwood, all of Kamloops, and Mr. Kingwell was elected to the post at a salary of $1,800 per year.

Plans have been completed for a new building, estimated to cost $125,000, for Calgary University, and tenders are about to be called. The architects are Messrs. Hodgson, Bates & Beatty, of Calgary.

Mr. Robert Moore, proprietor of the St. Elmo Hotel, Edmonton, has received plans for a hotel building, costing $300,000, to be erected on the site of the present structure. Work is to begin this month.

English-speaking members of the R. C. Church in Edmonton are planning to erect an edifice to cost $100,000. It will be known as St. Joseph's Church and situated in Eleventh street. Work is to begin this spring.

The waterworks system at Regina is to be extended under the terms of a bylaw carried by the ratepayers. Mr. J. W. McKay is superintendent of the waterworks, and the cost of the undertaking is placed at $360,000.

Three hundred thousand dollars is the estimated cost of a ten-storey hotel building to be erected by Mr. Nat Bell, proprietor of the Pendennis Hotel in Edmonton. The hotel will be built of steel, pressed brick and terra cotta.

The building committee of Robertson Presbyterian College has decided to erect a theological building, costing $150,000, on the grounds of the University of Alberta, in Edmonton. It is to be ready for the 1915-6 term.

The Hudson's Bay Company, of which Mr. A. E. Dodman is general manager, is making extensive improvements at its big store in Edmonton. The most important is the display window arrangement in Jasper avenue and Third street.

Mr. G. W. Fuller, manager of the G. A. Fuller Company of Winnipeg, reports that work on the superstructure of the Arts building for the University of Alberta in Edmonton will begin early in June. The structure will cost about $500,000.

Plans for a two-storey store and apartment building for Wilkinson Brothers have been received by the Builders' Exchange, the block to be erected at the corner of First street and Vermillion avenue. Mr. James Henderson is the architect.

Messrs. Dalton and Gardiner are having plans prepared for a five-storey warehouse, 100 x 130 feet, to be erected this year on the Hudson's Bay reserve in Edmonton. Foundation and walls will be of maple dimensions to carry three additional floors.

Messrs. Olson & Johnson have started cement work on the McLeod Building, for which the steel work was completed last fall. The city of Edmonton has loaned $350,000 to the owner to complete the structure, which will be the highest in Edmonton.

Plans have been prepared by a Vancouver firm of contractors for a six-storey mercantile establishment in Edmonton, costing about $800,000. The building is to be occupied by the James Ramsey Company's department store, now housed in the Tegler Building.

There is a possibility that the well-known English firm of Doultons will start a china clay factory in Canada. A member of the firm is at present on his way to South Alberta for the purpose of examining the china clay deposits in that part of the Dominion.

Mr. George Pearson, a capitalist, of Warwick, Eng., announced in Edmonton on March 20 that his plans for this year include the erection of a ten-storey business and office building, costing $600,000, and a theatre building with a seating capacity of 2,500, estimated to cost $400,000. The structures, upon which work will begin within the next sixty days, are to be situated in Second street, the last named adjoining the Empire hotel.

Realizing the necessity for the provision of harbors of refuge on the Great Lakes, Hon. Robert Rogers, Minister of Public Works, has undertaken to send departmental engineers to the Bruce County Shore on Lake Huron, to investigate harbor possibilities at Inverhuron.

At Edmonton, Alta., operations have been renewed on the erection of a ten-storey store and office building of terra cotta and pressed brick construction estimated to cost $450,000. The architect is Mr. J. K. Dow and the general contractors are Messrs. Olson, Johnson Company.

The city of Calgary, Alta., will require three-quarters of a million dollars in cash to carry on its various works and municipal activities within the next three months. Amongst the items decided on is that of $100,000 for a paving plant, $125,000 for electric light and power and $50,000 for waterworks improvement.

Civic improvements, involving capital expenditures of more than $2,400,000, will be submitted for approval to the ratepayers of Edmonton on April 6. The city council has passed these expenditures and others to the amount of $7,456,872, of which $2,099,667 is to be set aside as a working capital. Three million dollars will be expended upon street, sewer and similar improvements.

The Bank of Alberta, recently incorporated under a Dominion charter, will expend $250,000 in the construction of a modern bank and office building in Edmonton, according to an announcement made by Mr. E. S. McQuaid, solicitor and a member of the directorate of the bank. The new building, to be used as head offices of the bank, will occupy a prominent site in the business district.

Announcement was made recently by the Hon. Geo. E. Foster that legislation will be introduced shortly to give the grain commissioners more control of the grain elevators from Fort William to the ocean. For the construction and operation of terminal and interior elevators a vote of five and a half millions was made, and Mr. Foster stated that interior elevators would be constructed at Saskatoon, Moose Jaw and Calgary, a transfer elevator in British Columbia and an elevator at Hudson Bay, the two first-named elevators to be ready this season. The tenders of Messrs. Barnett and McQueen for the erection of the Saskatoon and Moose Jaw elevators at $2,500,620 was accepted by the government. Plans are in course of preparation for the Calgary elevator.

Mr. H. C. Drake, engineer in charge of construction, recently gave particulars of the oil refining plant to be located near Port Moody, B.C., by the Imperial Oil Company. Preliminary work will be commenced shortly pending the arrival of the steel for the tanks and the completion of the spur line from Port Moody. There will be thirty-five tanks altogether, three of which will be 93 feet in diameter and 35 feet in height, with a capacity of 200,000 gallons each. A wharf 750 feet long with an "L" branch will be built out to deep water for the accommodation of the big oil tank steamers which will bring fuel from California. A large pumping station for discharging the cargoes from the tankers into the reservoirs and transferring the crude oil from one section to the other during the refining processes, will be provided. The plans which have been prepared by the Imperial Oil Company, provide for the gradual expansion of the refining plant as the business in the west grows.

There appears to be a difference of opinion between the Premier of British Columbia and the Burrard Inlet Tunnel and Bridge Company as to the cost of building the Second Narrows bridge. Some time ago the government declined to give the company further aid in connection with the original request of the directors that the authorities at Victoria take over the whole project and construct the bridge themselves. The government also declined to provide a guarantee for a bond issue of $750,000, claiming that its grant of $400,000 was sufficient at the present time and pointing out that as the bridge company was short of having sufficient to complete a $2,500,000 structure as provided for by the Wolfe-Barry plans, it should go ahead with a cheaper bridge. Plans for a bascule type bridge were prepared for the government by Mr. P. C. Moss, formerly engineer in charge of the bridges built for the city. According to his plans a bascule bridge could be constructed across the Inlet at the Second Narrows at a cost of $1,500,000, as compared with $2,500,000 for the somewhat larger bridge provided for by Sir John Wolfe-Barry. The bascule bridge would have spans of forty-four feet, centre to centre of trusses, and provide for two railway tracks, each with overhead trolley wires, which would give continuous and uninterrupted traffic of trains and electric cars in both directions at the same time. In addition there would be a 16-ft. roadway for vehicular traffic. Outside of the truss is an 8-ft. sidewalk for pedestrians. The overhead clearance is forty-five feet from the surface of the water at high tide to the underside of the spans over navigable water. The movable span is a bascule of the Heel trunnion type, rotating upward from the main trunnion (short shaft) in journal bearings secured to the end of the supporting span, being exactly balanced in all positions by the concrete counterweight which rotates downward through the same angle as the span. The bascule span and counterweight are connected by a pivoted link which moves parallel to the end post of the supporting span. A small latch is drawn and the simple movement of raising commences and vice versa after the vessel has passed. The span is latched to the pier when closed by a 5 h.p. motor. All the piers are designed to be of concrete.

Canadian Railroad Development

Regina's street railway system is to be enlarged at a cost of a quarter of a million dollars.

The C. P. R. contemplate the double-tracking of their line from Port Arthur to Sudbury at a cost of $6,000,000, from Calgary to Brandon at a cost of $5,000,000, and from Revelstoke to Vancouver at a cost of $7,000,000.

The foundations for the new one-million-dollar hotel which the Grand Trunk Pacific is erecting at Regina are complete and work will be resumed about the middle of this month. The architects are Messrs. Ross & MacDonald and the contractors the Lyall, Mitchell Company.

Messrs. Westinghouse, Church, Carr & Company, of Montreal and New York, are the engineers who have been retained by the Canadian Pacific Railway, in connection with the proposed double-track, six mile Selkirk tunnel in British Columbia. The investigations, which will be of a preliminary character, are expected to cover in general the relative economies of steam and water power, the effect of the electrification upon operating conditions.

In preparation for the establishment of docks for ocean-going vessels and railway terminals at Squamish, the Pacific Great Eastern Railway intends to proceed with the reclamation of an area one mile in extent during the coming summer. In an announcement made recently in which Mr. G. W. Stewart, president of the company, outlined their plans for development and construction, he pointed out that when the work on all the new sections was under way [illegible] would be provided for more than [illegible] men.

Montreal's Building Programme

As far as can be judged at this early date, the building operations in the Montreal district should be fairly important. Within the last three years, many office buildings have been erected, and for the present the demand in that direction has been about met, so that little work of that character will be carried out during the season. Some buildings started last fall will have to be completed and this will provide a moderate amount of employment. The new custom house is probably the largest individual job to be executed, while contracts for several churches, schools, theatres and factories will be let. The greatest requirement of the city, however, is additional residences, to house the increasing population. Small residences and flats are in very short supply, and there is a pressing demand for these —a demand which last year was not really satisfied. Rents have risen in every part of the city, and yet houses were rented before they were erected. The great majority of the permits taken out this year are for residences, a significant feature being the number of eight and ten-storey apartment houses to be constructed. There are indications that the workmen will try to enforce a considerably higher scale of wages; the employers will probably be willing to make concessions to some classes, but trouble will follow should the men unduly press for wages and hours which conditions do not warrant.

Industrial Enterprise in the Maritime Provinces

An outstanding example of industrial activity in the Maritime Provinces is to be found in the enterprising policy of the Standard Clay Products, Limited, whose chief offices are situate at St. Johns, Que. The latest addition to the company's operations is a new plant located at New Glasgow, N.S., which is claimed by them to be the largest sewer pipe plant in Canada. It is equipped with machinery of the most modern and up-to-date type as the following list of makers will show:—Two Stevenson sewer pipe presses, two 9-ft. Stevenson dry pans, four 8-ft. Stevenson wet pans, a 400 h.p. Goldie & McCulloch engine, and four 18 ft. x 6 ft. Matheson boilers. The plant also includes an electric light engine and dynamo, as well as motor driven and gravity power elevators. The equipment comprises dies for the manufacture of sewer pipes from 4-in. to 30-in. diameter. Ten kilns each of 34 ft. capacity have been erected, while five more are to be installed this spring.

View of plant No. 3, New Glasgow, N. S. Standard Clay Products, Limited.

The company owns seventy acres of clay and shale lands at New Glasgow, with shale beds about 60 ft. thick above drainage, and extending about 1,000 feet in depth. These beds contain several hundred millions of raw material for the manufacture of clay products. In addition to this plant the company is operating another sewer pipe plant about 300 yards distant, which latter was established in 1904. The principal lines manufactured by the company comprise salt glazed, vitrified sewer pipes, culvert pipes and sewer pipe connections of all descriptions, hollow building blocks, chimney tops, inverts, vases and all kinds of vitrified and fire clay ware.

It will be remembered that the firm's No. 2 plant at New Glasgow was partially burnt down on March 12. However, the work of reconstruction is proceeding rapidly and in the near future everything will be in working order as before. The operations of the Standard Clay Products, Limited, are very far-reaching and the facilities for output will be greatly added to by the new factory at New Glasgow, an illustration of which appears with this notice.

Mr. Walter C. Allen has been elected vice-president and general manager of the Yale & Towne Manufacturing Company, New York, Mr. Allen entered the service of the company in a minor capacity in 1901 and has risen from the various manufacturing and administrative departments to the responsible position he now holds.

The business of the Tungstolier Company of Canada has been taken over by the Canadian General Electric Company, Limited. It is the intention to carry in stock a large assortment of electric fixtures for both commercial and residential lighting. Communications regarding fixtures and glassware should be addressed to the Canadian General Electric Company, Limited, Fixture Section, Toronto, or to their nearest district office.

An interesting booklet received from Messrs. Bechtels, Limited, Waterloo, Ont., deals with a line of steel dump cars and industrial railroad equipment manufactured by this firm. The various types of car are described in detail, the dimensions being given very carefully in each case. It is pointed out that for general use in brick yards, contracting work, sand pits, and even in mines, the side dump car offers many advantages over other styles, while the bottom dump car has the claim to preference for the transportation of bulky material. The Bechtel rotary scoop car and the Bechtel gable bottom car are among other types featured. In addition to the dump cars various other equipment is described, such as turntables and portable track.

The B. F. Sturtevant Company of Canada, Limited (919 New Birks Building, Montreal) have an encouraging list of recent contracts which are now being executed at their plant in Galt, Ont. Upon looking through this list we find that ventilating apparatus has the place of honor, the contracting for such having been made for the Dandurand Building, St. Jean L'Evangelist School, Drummond Building, Longue Point School, the Shawinigan Water & Power Company's building, the Poupart Street School and the buildings of the National Breweries, Limited, who are said to have the best ventilating apparatus in Eastern Canada installed in their new stables. Continuing through the list we find that the Sturtevant Company have the contract for a large variety of other equipment, such as rolling mill equipment, cotton conveying apparatus, fans, induced draft apparatus and equipment for a new forge shop. These facts indicate that the Sturtevant Company is able to furnish the Canadian trade with the right goods at Canadian prices.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Berlin, Ont.

Surveys have been made for the laying of creosote block pavements on Water and Weber streets.

Calgary, Alta.

The city council has decided to start work at once on the Bow River tunnel, to be used in connection with the new pumping station.

Charlottetown, P. E. I.

The city council is considering the purchase of 5 new water cranes.

Eastview, Ont.

A proposition is before the town council to repair the Montreal road from the toll gate to the cemetery.

Galt, Ont.

The question of the construction of a reservoir has been abandoned by the town council.

Granby, Que.

The municipal council has under consideration the laying of a watermain on Main street.

Guelph, Ont.

The laying of cement sidewalks and sewers on certain streets is contemplated by the city council.

Howard Twp., Ont.

Tenders will be received by the Township Clerk, Geo. McDonald, Ridgetown, until noon April 4th, for the construction of the following drains. McCoy drain, estimated cost $560; Harrison drain, estimated cost $950; Grant and Skakel drain, estimated cost $2,769; South Marsh drain, estimated cost $2,855; S. branch South March drain, estimated cost $700. Plans, etc., are at the clerk's office.

Montreal, St. Lambert

Plans are being drawn for a trunk sewer and sewage disposal plant. About 9,500 ft. 36 in. by 30 in. and 45 in. by 30 in. concrete sewer pipe, will be required. Town engineer, E. Drinkwater.

Surveys have been made for the construction of waterworks, sewers, etc., at an estimated cost of $480,000. Work will be started about May 1st.

Moose Jaw, Sask.

A bylaw is to be submitted to the ratepayers for sewer and watermain extensions to Wellesley Park at a cost of $27,750.

The city council will probably call tenders shortly for the laying of pavements on Manitoba St., 6th Ave. and 5th Ave.

Morse, Sask.

The Saskatchewan Local Government Board has authorized the town authorities to raise the sum of $5,000 for concrete walks and grading.

Ormstown, Que.

Tenders for the laying of macadam roadways at per mile will be received by J. G. Bryun, Sec.-Treas. to the Municipal Council, until April 6th; the contractors are to furnish crusher plant and material.

Swift Current, Sask.

The city has been authorized to raise funds for the purchase of a site for the construction of a waterworks system.

Saskatoon, Sask.

The city has decided to build a fully modern sewage disposal plant and intercepting sewer, a site for which has been purchased.

St. Joseph d'Alma, Que.

Tenders for the laying of macadam roadway will be received by the engineers-in-charge, A. Morin & Henry, C.E., Quebec, until April 6th; estimated cost $25,000. The purchase of road machinery is being considered by the municipal council.

Toronto, Ont.

The following work has been recommended by the Commr. of Works. Pavements: asphalt on Coxwell Ave. $9,368, Bracondale $15,696; bitulithic on Orchard Park $3,463, Rainsford Rd. $9,033. Cement, concrete sidewalks on Bathgate, Cunningham, Duplex Sts., Danforth, Glen Grove, Lunsmore, Dufferin and Strathgowan Sts. Estimated cost $10,238.

Victoria, B.C.

Tenders will be received by the City Purchasing Agent, W. Galt, until 4 p.m. April 27th, for an 8-ton steam roller.

Waterloo, Que.

Tenders will be received by J. A. Perras, town Sec., until May 1st, for the construction of a concrete sidewalk 1 mile long by four feet wide.

Welland, Ont.

Tenders will be received by the Town Clerk, C. M. Webber, until 4 p.m. April 16th, for the construction of sidewalks for the year 1914. Specifications are at the offices of City Engineer, Welland, and Hugh C. MacLean, Ltd., 220 King St. W., Toronto.

The Paving Committee of the town council has decided to pave Division St., Hellems Ave. and Cross St., with brick and concrete road leading from Division St. to the market. Estimated cost $20,000.

Wilkie, Sask.

The town has been authorized to raise the sum of $7,000 for waterworks purposes.

CONTRACTS AWARDED

Brantford, Ont.

The contract for laying sewer pipe has been awarded by the city council to Toronto & Hamilton Sewer Pipe Co., Hamilton, $11,867.

Edmonton, Alta.

The following contracts for waterworks material have been awarded by the City Commissioners: cast iron pipe, Canada Iron Foundry Co., 751 9th St., Price, $43.25 per ton for pipe and $71 per ton for specials; gate valves, Jenkins Bros., 6-in., 8-in., 14-in. and 16-in. Price, $5,189.96; Drummond, McCall & Co., price $50.25 each, $7,537.50; steel pipe, General Supplies, Ltd., at $2 per foot for 5,600 ft. 16-in. pipe and $2.95 per foot for 13,300 ft. 20-in. pipe; Smiley & Co., 546 1st St., Edmonton, at $1.70 per ft. for 14-in. pipe and $8.70 per foot for 30-in. pipe; pig lead, Western Supplies Ltd., 8th St.; water meters, 3,670 at $36,865, ordered from: Smiley & Co., Walsh & Charles, National Meter Co., Western Canadian Agency, Siemens & Co. Only a portion of meters has been ordered as the Superintendent wishes to make tests of other kinds. Contracts have also been awarded by the City Commissioners to Canadian Equipment & Supply Co., 751 Ninth St., Edmonton, for sewer pipe of different lengths and sizes, at $141,946.05, and to Smiley & Co., 546 1st St., Edmonton, for stoppers.

Montreal, Que.

The contract for the construction of the filtration plant has been awarded by the Board of Commrs. to F. J. Jago Co., 10 Victoria St.

Prince Rupert, B.C.

The Municipal Council has awarded to Gerald Lomer, Ltd., 43 St. Sacrament St., Montreal, the contract for the supply of 10,000 ft. 45-in. lapwelded steel pipe at $6.55 per lin. ft., Class A & B, and $6.87 for Class C, 12,000 ft. 18-in. pipe at $2.17 per lin. ft.

Saskatoon, Sask.

The contract for renewing the road surface of Long Hill, Nutana, has been awarded by the City Council to J. Gunn & Sons, Bank of Nova Scotia Bldg., Winnipeg, Man.

Toronto, Ont.

The following contracts have been awarded by the Board of Control. Frank Angotti, 7 Pendrith Ave., laying sewer [illegible] Woodside $1,308; Garfield $1,934; Mount-[illegible]

The contract for the following pavements has been let by the Board of Control to the Commr. of Works. Asphalt pavements on [illegible] $6,655; Hartford $1,223; Herbert $693; [illegible] Mountalan $2,225. Bitulithic pavements on Brock $3,036; Gillard $7,164; Mount [illegible] $1,194.

Welland, Ont.

The following bids for sewer work were opened on 19th March, 1914. J. Y. Harper, St. Thomas, $5,278.80; Louis [illegible] Niagara Falls, [illegible] ville & Reid, Welland, $6,937.70; W. [illegible] Hamilton, $[illegible]; Peter Lo[illegible] [illegible] Falls, $[illegible]; Mill & [illegible], Toronto, $[illegible].

A contract has been awarded by the town council to Mill & Baird, 67 Victoria St., Toronto, for the construction of [illegible] on [illegible], Edward, Queen and [illegible] streets.

Winnipeg, Man.

[illegible] for the laying of sewers has been awarded by the Board of Control to J. W. Astley, Engineer of Con[illegible]

Railroads, Bridges and Wharves

Cardston, Alta.

A by-law is being prepared for authority to borrow the sum of $11,000 for the construction of a dam.

Chatham, Ont.

Mr. H. Swartz, of the Grand Trunk Rly. Co., has been looking for a suitable site for the erection of a station and freight shed.

Cornwall, Ont.

The Cornwall & Hawkesbury Railway Co. has filed an application for power to construct a railroad from Cornwall to Hawkesbury via Martintown and Alexandria.

Coteau du Lac, Que.

Tenders for the construction of a steel bridge with concrete abutments will be received by the Municipal Sec., A. Dumesnil, until April 4th. Plans and specifications are at the office of the Sec. and the Engineer, L. A. Vallee, 80 St. Cyrille St., Quebec.

Calgary, Alta.

The following plans for bridge construction have been recommended: a reinforced concrete bridge across Bow River at Center St., cost $243,000; a steel bridge to be built alongside the Louise bridge, cost $155,000; concrete bridge across the Elbow River to replace the present Mission bridge, cost $77,600.

Moore Twp., Ont.

Reeve D. P. Shaw, Bridgen, will receive tenders until April 16th, for the construction of a double span steel bridge, 80 and 50 ft. spans, building concrete abutments and a pier for same.

Nanaimo, B.C.

Tenders will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. April 28th, for enlarging and deepening the harbor and its entrance; sand, mud and silt, 131,000 cu. yds. Specifications are at the office of the Dept., Ottawa, and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Neepawa, Man.

Tenders will be received by M. Chisholm, Sec.-Treas., up to April 25th, for the construction of a reinforced concrete bridge. Plans and specifications at the Highway Commrs. office, Winnipeg, and at the Municipal Office, Neepawa.

Province of Ontario

The C. P. R. will apply for a charter this session to build a railway line from Cornwall to Hawkesbury.

Port Burwell, Ont.

Tenders will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. April 9th, for the necessary dredging at the channel entrance to the harbor. Specifications at the office of the Dept., Ottawa, and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Sherbrooke, Que.

A concrete dam, 22 ft. high, will be constructed to replace the present dam at the city power station. Engineer, Thos. Tremblay, City Hall.

St. Catharines, Ont.

Tenders for section 4a of the Welland Canal will be received by L. K. Jones, Sec. to the Dept. of Railways and Canals, Ottawa. Plans are at the office of the Chief Engineer of the Dept., Ottawa, and the Engineer-in-charge, St. Catharines.

St. John, N.B.

A report submitted by the city engineer recommends the reconstruction of north wharf with concrete, at an estimated cost of $45,000.

Toronto, Ont.

Tenders received by engineer, Frank Barber, 57 Adelaide St. E., until April 6 for the construction of Massey bridge.

Winnipeg, Man.

The C. P. R. proposes to double track the line from Port Arthur to Sudbury, a distance of 1,338 miles, at a cost of $6,000,000; Calgary to Brandon $5,000,000; and Revelstoke to Vancouver $7,000,000.

CONTRACTS AWARDED

Island Brook, Que.

The bridge contract has been awarded by the Municipality of Sawyerville to Dawson Bros., Island Brook.

Public Buildings, Churches, Schools, etc.

Argyle, Man.

Plans are in progress and tenders will be called immediately for the erection of a school building for the Argyle School District, at a cost of $7,000. Architect, F. R. Evans, Somerset Bldg., Winnipeg.

Calgary, Alta.

The City Commrs. have recommended awarding a contract to Tees & Persse of Alberta, Ltd., Peace and Seventh St., at $8,095, for the supply and erection of 52 cells, 8 of which are to be tool proof with multiple locking mechanism and balance mild steel.

A site has been selected and plans are being drawn by R. P. Blakey, architect, for the erection of a jail.

Chatham, Ont.

The time for receiving estimates and plans for addition to the "Queen Mary" school has been extended to April 18th. Sec., Chas. E. Beeston, Harrison Hall.

Durham, Ont.

Tenders are invited by the Town Clerk, Wm. B. Vollet, for veneering and renovating the town hall, also for an addition to the south end.

East London, Ont.

The erection of a high school on Dundas street is being considered by the Board of Education.

Emerson, Man.

Tenders for the erection of a school at the Marais will be received by Sec.-Treas., Wm. Shields, up to April 15th. Contractors are to furnish all material and complete construction, or Trustees will furnish material and contractors do work. Plans and specifications are with the secretary-treasurer.

Edmonton, Alta.

Tenders will be received by Deputy Supt. Gen., Duncan Scott, Dept. of Indian Affairs, Ottawa, up to 12 o'clock noon April 17th, for the construction of farm buildings for the Alexander Band, Edmonton Agency, Alta. Plans and specifications are at the Dom. Lands Office, Edmonton, at the office of Indian Agent, Edmonton, and at the Dept., Ottawa.

The construction of a new incinerator, at a cost of $140,000, is being considered by the City Commrs. as the one now in use is not satisfactory.

Egremont Twp., Ont.

The erection of a school building is being considered by School Sec. No. 9, and a site is to be chosen shortly.

Guelph, Ont.

Tenders for the erection of a 6-room school building for the Separate School Board, at a cost of $14,000, will shortly be called. Architect, W. A. Mahoney.

Hamilton, Ont.

Plans have been drawn for a club house for the East Hamilton Progressive Assn. who are negotiating for a site. Architect, Wm. Kinch, 42 Frederick St.

Hardisty, Alta.

Tenders will be received by the Sec.-Treas., Alex. Mursell, up to April 11th, for the erection of a 4-roomed brick school building. Plans and specifications are with A. E. Beswick, 603 Tegler Blk., Edmonton.

Kamloops, B.C.

The plans for the new drill hall are about completed.

Kintore, Ont.

W. G. Murray, Dom. Savings Bldg., London, has been appointed architect for the new Presbyterian Church.

Kuper Island, B.C.

Tenders for the erection of an industrial school will be called by the Public Works Dept. shortly.

Listowel, Ont.

Plans are to be discussed at the next meeting of the council in connection with remodelling the town hall recently damaged by fire. The erection of a steel hose tower will also be considered.

London, Ont.

The erection of a school building on Adelaide and St. James Sts., is proposed by the Board of Education.

South London, Ont.

The erection of a high school building, on Tecumseh Ave., is being considered by the Board of Education.

Mitchell, Ont.

Tenders for the erection of a school building will be received by Wm. Martin, secretary to the school board, until April 15th. Specifications at the office of the secretary, and J. S. Russell, architect, 21 Downie St., Stratford.

Midland, Ont.

Plans, etc., for the erection of a public school are at the office of the Sec., C. D. Trueman, King St., who will receive tenders until April 6th. Heating and plumbing tenders to be separate. Architects, Stewart & Witton, 7 Hughson St. S., Hamilton.

Medicine Hat, Alta.

Plans for the erection of a deliquent childrens home, at a cost of $6,000, have been drawn by J. Daley, architect, City Hall, Medicine Hat.

Montreal, Que.

J. P. Hynes, 119 Yonge St., Toronto, has been appointed architect for the assembly hall on Dorchester St. W., for St. Patrick's Parish.

Plans for the erection of a club house, on Cherrier St., National Amateur Athletic Assn., at a cost of $200,000, will probably be ready for tendering about May 1st. Architects, J. A. Ouellette, 250 Amherst St., and J. O. Turgeon, 55 St. Francois Xavier St.

Montreal, Que., Verdun

A club house to cost $20,000 is contemplated by the Verdun Athletic Club. Pres., Wm. Evely, 449 Bleury St., Montreal. Club to decide upon site shortly.

Nepean Twp., Ont.

Three lots have been purchased on Carling Ave., outside Ottawa city limits, for the erection of a Roman Catholic school and chapel.

Ottawa, Ont.

Tenders for rebuilding the hall in the Exhibitions Grounds will be received by the Mayor; estimated cost $20,000. Architect, W. E. Noffke, Central Chambers.

The Separate School Board proposes to make large school additions or a new one will be built in Dalhousie Ward.

Outlook, Sask.

Plans are being drawn for a college for the Sask. Norwegian Lutheran College Assn. Architect, Carl Volkman, Moose Jaw; estimated cost $25,000.

Portage la Prairie, Man.

Tenders for the erection of an industrial school for the Dept. of Indian Affairs will be called shortly.

Port Arthur, Ont.

Plans have been prepared and tenders will be called shortly for additions to the school building in the north and south wards. Architects, Hood & Scott, Room 43, Murray Block.

The erection of a cathedral, on Arthur and Algoma Sts., is being considered by the R. C. Denomination. The estimated cost is $140,000.

Prince Albert, Sask.

Tenders in connection with the erection of the Sacred Heart Cathedral, will be received by A. Graham-Creighton, Knights of Columbus Bldg., architect, up to April 13th, 1914, for: (1) complete work of new building, except plumbing, heating and electric wiring; (2) plumbing and heating; (3) electric wiring; (4) removal of chapel and razing of main portion of present building and carting away of all rubbish.

Ouebec, Que.

Tenders for the erection of a church for the parish of St. Roch, St. [illegible] St., will be called shortly; estimated cost $250,000. Architects, Talbot & Dionne, 16 St. Joseph St.

Plans are being drawn for a convent for the Sisters of St. Frs. D'Assise, 241 1st Ave., Limoilou.

St. Marys, Ont.

Tenders for the erection of a central school of 10 rooms will be received by Watt & Blackwell, architects Bank of Toronto Chambers, London, until April 15th.

A site has been purchased and plans are to be prepared for the erection of Salvation Army barracks at a cost of $6,000.

Stratford, Ont.

The question of an addition to the Strachan St. school has been proposed.

Sudbury, Ont.

Plans for the erection of a synagogue for the Jewish community have been drawn. Jos. Sanders is the chairman of the building committee.

St. Louis de Courville, Que.

Plans are being drawn for the erection of a church for the R. C. Denomination, at a cost of $40,000.

St. John, N.B.

As the selection of a new site for the tuberculosis hospital at Courtney Bay has necessitated certain alterations in the plans, new tenders are invited. The estimated cost is now $80,000. Architect, F. Neil Brodie, 42 Princess St.

Toronto, Ont.

Tenders for the erection of a church on Christie and Yarmouth Sts., for the Epworth Methodist Church, will be received by J. H. Galloway, architect, 23 Toronto St., until April 8th.

Tenders for the erection of a Lodge building on Keele street for Lakeview Lodge I.O.O.F., No. 272, are invited by H. G. Paull, architect, 395 College St.

The Engineers Club of Toronto has purchased a site on Simcoe St. for the erection of club buildings. Sec., R. B. Wolsley, 96 King St. W.

Property Commr., D. Chisholm, has plans prepared for a temporary fire hall in North Toronto. Estimated cost $4,500.

Truro, N.S.

A project, in which Rev. W. MacMillan, D.D., 317 Pleasant St., Halifax is interested, is on foot for the establishment of a Home for Delinquent Girls. A site of 250 acres has been purchased.

Upsalquitch, N.B.

Tenders will be received by Sec.-Treas., Edmund Robertson, until April 15th, for the erection of a school building on lot No. 32. Plans and specifications are with the Trustees of Dist. No. 1[illegible], Upsalquitch, and at the office of S. S. [illegible], Campbellton, N.B.

Vancouver, B.C.

A permit for the erection of a hall, on Davie St., at a cost of $25,000, has been issued to [illegible] Hastings St. E. Architects and general contractors, [illegible].

Victoria, B.C.

[illegible] and alterations to the post office will be received by [illegible], Sec. Public Works Dept., Ottawa, until [illegible] April [illegible], for heating and ventilating system. Plans, etc., are at the office of Wm. Henderson, Resident Architect, Victoria, Postmaster, Vancouver and at the Dept., Ottawa.

Westboro, Ont.

Plans have been drawn and tenders will be called shortly for the erection of a school building; estimated cost $18,000.

Weyburn, Sask.

Plans for the erection of a court house, at a cost of $60,000 are being drawn by B. R. Philbrick, architect, Dept. Public Works.

Windsor, Ont.

The Grand Jury has condemned the present quarters in the basement of the City Hall, and recommend that a new police station be built.

CONTRACTS AWARDED

Ayr, Ont.

The school contract has been awarded by the Reidsville School Board to George Cress, Ayr. Architects, Evans & Fulford, Scott & Bennett Block, Galt.

Charlottetown, P. E. I.

The contract for alterations to the market building has been awarded by the city council to McLean & Baret.

Halifax, N.S.

The contract for painting and glazing in connection with the erection of the dormitory building of the Pine Hill Presbyterian College has been let to D. Roche, 238 Argyle St.

Kingston, Ont.

The contract for heating, plumbing and electrical wiring has been let by the Regiopolis College to Bennett & Halligan, 191 Princess Street.

Montreal, Que.

The contract for the erection of the public bath, on Seigneur St., has been awarded by the Board of Commrs. to L. Langevin, 228 Parc Lafontaine.

The contract for alterations to Dr Hertz's Institute, Milton and St. Urbain Sts., has been let to A. M. Vilensky, St Urbain St.

Montreal, Que., Rosemount

The contract for the erection of a school for the School Commrs. of St Francois Solano, has been awarded to A. Fillon, 2419 St. Denis.

Montreal, Que., St. Lambert

Mr. Gordon, Greenfield Park, has secured the contract for the erection of a school for the School Commrs., Greenfield Park.

St. John, N.B.

The contract for painting the new post office, on Prince William St., has been let to H. L. & J. T. McGowan, 137 Princess St.

Ste. Luce, Que.

The contract for the erection of the Roman Catholic Church has been awarded to Jos. Dagneau, Notre Dame du Sacri Coeur, Rimouski. Architects, Ouellet & Levesque, 115 St. John St., Que.

Thorold, Ont.

The school contract has been awarded by Wilson & Summers. Architect, A. E Nicholson, 46 Queen St., St. Catharines The building is to be completed by October 1st.

Toronto, Ont.

The following contracts have been awarded in connection with the addition to Connaught Ave. School Carpentry, M. Hutchinson, 5 Duke St., $6,823; plastering, [illegible] White, [illegible] $[illegible]; painting, [illegible]

[illegible] iron stairs, Can. Ornamental Iron Co., 88 River St., $2,540; plumbing, Lewis Legrow, 92 Harbord St., [illegible]

Victoria, B.C.
The contract for addition and alterations to the post office has been awarded by the Public Works Dept., to McAlpine, Robertson Construction Co., Metropolitan Bldg., Vancouver.

Walkerville, Ont.
The following contracts have been awarded in connection with the erection of the Ontario St. School. Masonry, carpentry, steel and plastering, Wells & Gray, Manning House Block, Windsor; painting, H. B. White; heating, Walkerville Hardware Co. Architects, Stahl, Kinsey & Chapman, Strathcona Block.

William Head, B.C.
The contract for the erection of the detention building has been awarded by the Public Works Dept., to R. Montrief, Birks Bldg., Vancouver.

Winnipeg, Man.
The contract for the erection of St. Luke's Rectory and school has been awarded to Frid Lewis & Co., Somerset Bldg.

Winnipeg, Man., St. Vital
The contract for the fire and police station has been let by the Rural Municipality of St. Vital, to Frid Lewis & Co., Somerset Bldg., Winnipeg.

Business Buildings and Industrial Plants

Blairmore, Alta.
The erection of a mill, at a cost of $200,000, is being considered by the McLaren Lumber Co. New machinery, boilers, etc., will be required.

Calgary, Alta.
H. R. Hull, of the Grain Exchange, contemplates making a two-storey addition of sandstone and steel construction. Architects, Hodgson, Bates and Beattie.

Tenders for the erection of the industrial housing building, on 8th Ave. W., will be called April 15th and will close about May 1st. The buildings is to be completed by next September. Architect, A. Pirie, 231 8th Ave. W.

Camrose, Alta.
Mr. De Vries, architect, is inviting tenders on the erection of a four-storey hotel for the Calgary Brewing Co.; estimated cost $70,000.

Cayley, Alta.
The Alberta Farmers Co-operative Elevator Co., Ltd., have sold shares to raise funds for the erection of an elevator. G. D. Sloane & Wm. Caspell comprise the local board.

Cowansville, Que.
A site has been purchased and the erection of an up-to-date sash and door factory, on Depot St., is being considered by Poulin & Bissette.

Edmonton, Alta.
Plans for the erection of a 3-storey business and apartment block, on Norwood Blvd., are being prepared by R. H. M. Bailey, Main St. S., Edmonton.

Work on the erection of club house and apartments, on 2nd and Victoria Ave., for the Northern Club, is about to start again. Architects, Magoon & MacDonald, 604 Tegler Bldg.

The American Automatic Damper Co., Portland, Oregon, contemplates building a branch factory here.

The erection of a 5-storey wholesale warehouse, on 4th St., is contemplated by Dalton & Gardiner, 714 6th St. Provision will be made for the addition of three more storeys if necessary.

The erection of 3 stores and apartments, on 1st St., at a cost of $30,000, is proposed by R. Cleland, 644 14th St.

Messrs Goldsmith & Brody, 537 Clair St., are interested in a projected hotel on Jasper Ave. E., which will be built if a license is granted.

Eburne, B.C.
The Huntting-American Lumber Co. of Vancouver is negotiating for a site and has asked town council for certain privileges regarding erection of a sawmill; estimated cost $50,000.

Edmonton, Alta.
Plans are in progress for the erection of a bank building for the Bank of Alberta.

The Empire Theatre Company has under consideration the erection of a 10-storey office building on 2nd St. at a cost of $600.000.

Embro, Ont.
Libby, McNeil & Libby, of Chicago, Ill., propose to build 3 milk condensers here.

Ford City, Ont.
Plans are in progress and tenders will be received by G. Jacques & Co., architects, Windsor, until April 9th, for the erection of store and flats for Chas. Montreuil.

Goderich, Ont.
Tenders for addition to the plant of the American Good Roads Machinery Co. are invited. The owners have their own designs, but will depend upon the steel contractors for the working plans. Estimated cost $90,000.

Gravenhurst, Ont.
The Flax Towels, Ltd., will erect a plant to manufacture towels, etc. A linseed oil mill is to be erected shortly.

James Island, B.C.
Purchasing Agent of the Can. Explosives Ltd., 120 St. James St., Montreal, wishes to receive tenders at once on the steel work connected with the erection of a plant here.

Kelowna, B.C.
Information regarding the erection of the canning factory plans for which are being drawn can be obtained from W. Beaver Jones, Publicity Commr.

Lethbridge, Alta.
Plans are in progress for a cold storage plant for the Southern Alberta Cold Storage Co., Ltd. Architects, Carver & Oliver, Sherlock Bldg. Estimated cost $60,000. Tenders will be called shortly.

Marysville, N.B.
The Canadian Cottons, Ltd., will shortly instal a beam dyeing plant in their factory, at a cost of $12,000.

Medicine Hat, Alta.
The installation of a complete dry cleaning, dying and pressing plant is contemplated by Begg Bros., Main St. E.

Tassie Bros., 326 Montreal St., are having plans drawn for the erection of a bakery and stables on 4th St. at a cost of $5,000.

Moncton, N.B.
Albert Sencennes, architect, Marr Bldg., Main St., has plans in hand for the erection of an arena, at a cost of $75,000.

Montreal, Que.
S. Vineberg, 316 Notre Dame St. W., is now receiving tenders for reinforced concrete, plastering, plumbing and heating connected with the erection of a theatre on St. Lawrence and Duluth Sts.; other tenders will be called later. Architect, C. Dufort, 192 St. Catherine W.

A permit for stores and bats on St. Lawrence St., to cost $15,000, has been issued to Z. Lamoreux, 3143 St. Lawrence Street.

A permit for alterations to stores, residences and office, at a cost of $15,000, has been issued to The Jas. Robertson Co., 142 William.

Barott, Blackader & Webster, architects, New Birks Bldg., are receiving tenders for the erection of a $25,000 office building for the Estate of A. Hamilton Gault.

Plans for a boiler house for the Toilet Laundry Co., Ltd., (R. Cooke, 425 Richmond St.) are being drawn by Hutchison, Wood & Miller, architects, Royal Ins. Bldg., who invites tenders for General Contractor.

Can. Theatres, Ltd., London, Ont., have secured an option on property near St. Catherine St., and the question of building will be decided on shortly.

Niagara Falls, Ont.
Day & Co., 321 Locke St. S., Hamilton, will start a plant to manufacture wire cut bricks, using open kilns.

Ouiatchouan, Que.
Plans for the alterations to pulp mill of the Ouiatchouan Falls Paper Co. have been drawn. Grenon & Lavoie, Chicoutimi, are the engineers in charge.

Ottawa, Ont.
Tenders for alterations to the business building of H. Dube, Sussex and Clarence, are in, but it is expected that alterations may be modified and new tenders called.

Plans for a new store for L. N. Poulin, Ltd., Sparks St., are being drawn by W. E. Noffke, architect, Central Chmbrs. Estimated cost $150,000.

Alterations to the Laurier Ave. arena is contemplated. A promenade is to be installed, also new dressing rooms and a new lighting system.

A Workman & Co., Wellington St., are considering the erection of stores, etc., on Sparks street.

Plans for stables on Nicholas St., for Major & Soubliere, Nicholas St., are being drawn by W. E. Noffke, architect, Central Chmbrs. Estimated cost $10,000. Tenders will be called shortly.

Quebec, Que.
Plans for the erection of a bowling alley, at a cost of $10,000, are being drawn for P. Allaire, 15 Notre Dame des Anges St., and Jos. Devarennes, 81 Durocher street.

Quebec, Que., Limoilou
Tenders for the erection of bank premises for La Caisse d'Economie de

Notre Dame de Quebec, are invited by A. L. Robitaille, architect, 185 St. John St.

Regina, Sask.
The Woolworth Co., Woolworth Bldg., New York, N.Y., propose to erect a store on 11th Ave.

Sherbrooke, Que.
Plans for a store and residence for Thos. Taschereau, Windsor St., are being drawn by C. E. White, 137 Wellington St.

St. John, N.B.
Plans for a residence, barn and bakery to cost $7,000 are being drawn for H. Izzard, Victoria St., by H. U. Mott, architect, 13 Germain St.

Sunnyside, Ont.
Plans for addition to the hotel of Albemy Chappus, Ojibway, Ont., are being drawn by G. Jacques & Co., architects, Windsor. Work is to be started in the spring.

Toronto, Ont.
F. H. Miller, Lauder Ave., proposes to erect 4 greenhouses on Dufferin St.

Plans for 3 attached stores and apartments, on Agnes St., to cost $75,000, have been drawn for I. Roher, 73 Agnes St., by H. S. Kaplan, 41 Wolesley St.

Plans for the erection of a 10-storey hotel, on King and Simcoe St., for A. L. Solman are being drawn by Thos. W. Lamb, Stair Bldg., who will not be ready for tenders until after April 8th.

A site, 109 ft. x 235 ft., has been purchased on Dundas St. by Jos. R. Henderson, 46 Colborne St., for the erection of a warehouse.

Vancouver, B.C.
A permit for the erection of 4 stores on Granville St., has been issued to G. B. Harris, Exchange Bldg. Architects, Braunton & Leibert, Exchange Bldg. General contractor, J. Nelson Copp, 2840 Scott St. Estimated cost $17,000.

A permit for a laundry building, on Beach Ave. and Howe Sts., has been issued to the Cascade Laundry. Architect, Chas. Benthall, 1215 Jervis St. General contractors, Dominion Construction Co., North West Trust Bldg.

Woodstock, Ont.
The Canada Furniture Mfg. Co. proposes to build a 4-storey factory addition at a cost of $15,000.

Windsor, Ont.
Tenders for the erection of stores and flats, on Wyandotte St., are invited by Leybourne & Whitney until April 11th.

CONTRACTS AWARDED

Hamilton, Ont.
The carpentry contract on the 2 stores and apartments, on Barton St. E., for Geo. E. Mills, 614 King E., has been let to A. Mercer, 23 Grant Ave. Other trades will be let as required.

The following have been awarded contracts on the erection of [illegible] and apartments, on King St. W., for the Globe Realty Co., Lister Chmbrs. Concrete, J. Middleton, Ancaster, Ont.; mason, W. Aldridge, 28 Hunt St.; carpentry, R. Smithers, 85 Canada St.; plumbing, Clyde Plumbing & Heating Co., 202 York St.; electrical, O'Heir & Lewis, 74 York St. Architect, E. B. Patterson, 167½ King E.

London, Ont.
A contract for hotel alterations and additions has been let by Geo. H. O'Neil, prop. Tecumseh House, to Canadian Frost & Winchester Co., Ltd., Dundas St. E.

Montreal, Que.
The contract for the erection of stores, etc., on St. Catherine W., for the Jaeger's Sanitary Woolen System Co., Ltd., has been awarded to Atlas Construction Co., 37 Belmont St.

The contract for the erection of the factory for the Tuckett Tobacco Co., Ltd., has been let to C. E. Deakin, Ltd., 41 Mayor St.

Ottawa, Ont.
The following contracts on the erection of a theatre, on Queen St., have been awarded. Mason, Alex. Garvock, 136 Lewis St.; carpentry, J. Bratton, c/o Architect; other trades are not let yet. Architect, C. P. Meredith, 126 Sparks St.

The following contracts on stores and apartments for F. Brown, Lisgar St., have been awarded. Mason, J. Robertson, 227 Centre St.; carpentry, J. & C. Low, 262 Catherine St.; plastering, John Sutherland & Son, 30 Waverly St.; painting, P. Stewart, 301 Bank St.; heating and plumbing, H. A. Knox, Elgin St.; electrical, P. Ackroyd, 416 Bank St. Architect, W. E. Noffke, Central Chambers.

The contract for alterations to the store of M. Rosenthal & Co., Bank St., has been let to A. C. Burton, 509 McLeod.

St. Catharines, Ont.
The contracts for the erection of a factory for Lord & Burnham Co., New York, N.Y., has been let to The Samuel Austin & Son Co., Cleveland, O. Steel, Standard Steel Constr. Co., McCaw Block, Welland.

St. Marys, Ont.
The contract for the erection of the gymnasium, for the Board of Education, has been let to Stafford & Henderson. The contract for heating, electrical and interior fittings is not let yet.

Toronto, Ont.
The following contracts connected with the alterations to the premises of Bachrack Bros., 234 Yonge St., have been let: carpentry, Geo. Sparling 759 Dufferin St.; masonry, Holtby Bros., 275 Rusholme Rd. Other trades are not yet awarded.

The following contracts have been awarded in connection with the [illegible] of A. Pennylegion, 153 Duchess Street: masonry, [illegible] Construction Co., 787 Euclid Ave.; carpentry, J. A. Simon, 1844 Yonge St.; roofing, Bryan Bros., Richmond St.; painting and glazing, [illegible], 70 Parliament Street.

The following sub-contracts on the Holbrook warehouse, Florence St., have been awarded: steel, Toronto Structural Steel Co., [illegible] Ave.; steel sash, [illegible]; heating, H. G. Waterman & Co., 38 [illegible] Ave.; elevator, [illegible] Elevator Co., Bay Street; roofing and sheet metal, Douglas Bros., 124 Adelaide St. W.; plastering, R. C. Dancy, 153 Spadina Road; painting, F. C. Roberts & Co., 104 Wells St.; plumbing, Callis, Shepherd & Abbott, 25 Alberta Ave. Tenders on interior woodwork and fittings will be received by the Raymond Construction Co., 43 Victoria St.

A contract for the erection of a theatre, on Carlton St., for Wm. Stephany, has been awarded to T. P. Whitlam, 117 Summerhill Ave.

Jennings & Ross, engineers and contractors, 79 Spadina Avenue, have been awarded the general contract for the 5-storey and basement warehouse at 172 John St. for D. O. Roblin. Eden Smith & Son, 199 Yonge Street, Toronto, are the architects.

The contract for the construction of the motor cycle track, on Greenwood Ave., for the Toronto Motordrome Co., has been awarded to Geo. D. Kreamer, 143 Yarmouth road.

Winnipeg, Man.
The contract for alterations to the premises of the Henry Birks Co., Ltd., Portage and Smith Sts., has been let to F. W. Walker, 187 Harvard Ave.

The contract for additions to the plant of the Manitoba Cold Storage Co., Higgins Ave., has been awarded to Jas. McDiarmid & Co., Canada Bldg.

Residences

Granby, Que.
Plans for the erection of a tenement house, at a cost of $7,000, have been drawn by Edward Bradford.

Hamilton, Ont.
Plans for the erection of a $50,000 apartment house on Bold St., are being prepared by J. R. White, architect, Spectator Bldg.

Plans for the erection of a $100,000 apartment house on Bay and Herkimer Sts., are being prepared by Stewart & Witton, architects, 7 Hughson St. S.

Knowlton, Que.
Tenders for the erection of a summer residence for Wm. Scully, 320 University St., Montreal, are invited by Robt. Findlay, architect, 10 Phillips Place, Montreal, until April 4. Estimated cost $100,000.

Montreal, Que., Mt. Royal Heights
The City Realty Investing Co. of Montreal, Ltd., has purchased a block of land on N. Barclay and Lennox Aves., on which they intend building large apartment house this summer. The erection of a number of residences on Van Horne St. is also contemplated by the company.

W. E. Gilby, 41 Mayor St., Montreal, has purchased a site on Bedford Rd., and contemplates erecting flats thereon.

Montreal, Que.
Plans for the erection of 6 flats on Argyle St., have been drawn by C. Bernier, architect, 70 St. James.

Montreal, Que., Notre Dame de Grace
Plans for [illegible] residences are being drawn for [illegible] Park Ave., Montreal, who will probably call for tenders shortly.

[illegible]

(Continued on page [illegible])

Tenders and For Sale Department

CITY OF BERLIN

Tenders Wanted

The Board of Works and Sewerage Committee will receive tenders addressed to A. H. Miller, City Clerk, up to 6 p.m., **April 2nd next**, for the following for the year 1914:

1. Laying Cement Walks.
2. Combined concrete curb and gutters.
3. Cast iron catch-basin covers and manhole castings.
4. Concrete tile.
5. Sewer pipe.
6. Portland Cement.
7. Curb Irons.

Specifications may be seen at the office of the City Engineer. The lowest or any tender not necessarily accepted.

A. H. MILLER,
City Clerk.

Berlin, March 17, 1914 12-13

Department of Railways and Canals, Canada

Welland Ship Canal

Section No. 4A

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Section No. 4A, Welland Ship Canal," will be received at this office until 12 o'clock noon on **Thursday, April 9th, 1914.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Engineer in Charge, St. Catharines, Ontario.

Copies of plans and specifications may be obtained from the Department on the payment of the sum of fifty dollars. To bona fide tenderers this amount will be refunded upon the return of the above in good condition.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of $5,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque of the successful tenderers will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary

Department of Railways and Canals,
Ottawa, March 21st, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—[illegible] 12-13

Church Tenders

Sealed tenders addressed to the undersigned will be received until the afternoon of **Wednesday, April 15, 1914**, for the erection of a new Lutheran Church in the town of Hanover, Grey County, Ontario.

Plans and specifications will be on view at the office of the Collector of Customs.

The lowest or any tender not necessarily accepted.

D. WEPPLER,
Secretary-Treasurer.

Hanover, March 28th, 1914. 13-14

Notice to Contractors

Tenders will be received by the undersigned until 6 p.m., **Wednesday, April 15th, 1914**, for the building of a new Public School in the Town of Mitchell, Ont.

Plans and specifications may be seen at the office of the undersigned or at the office of the Architect, Mr. J. S. Russell, Stratford, Ont.

The lowest or any tender not necessarily accepted.

Marked cheque for 5 per cent. of the value of the work to accompany tender.

WM. MARTYN,
13 Secretary Public School Board.

The Housing Problem

Plans of Comfortable and Sanitary Houses

The Municipal Council of the City of Toronto announce the following plans competition:

With a view to promoting a study of the housing problem in Toronto and ascertaining the possibility of providing comfortable and sanitary housing at rates within the means of workingmen, the City will offer prizes for plans for model houses as follows:

1. For a detached house or cottage costing $800.
   - (a) Complying with present building by-law.
   - (b) Under amendments to bylaw suggested by competitor; first prize, $150; second prize, $100; third prize, $50.
2. For a semi-detached house or cottage costing $1,000.
   - (a) Complying with present building bylaw.
   - (b) Under amendments to bylaw suggested by competitor; first prize, $150; second prize, $100; third prize, $50.

Plans are to be submitted by May first next, and must be accompanied by specifications and estimates; estimates to be based on union or prevailing rate of wages.

Land frontage requirement is to be taken into consideration in awarding prizes.

The regulations governing the competition, which will be announced shortly, are being prepared by the Acting City Architect and the Property Commissioner, with the co-operation of the local Board of Health, and particulars in relation thereto may be obtained upon application at the office of the Property Commissioner, City Hall, Toronto, on and after Thursday, April 2, 1914.

H. C. HOCKEN, Mayor.

City Hall, March 27, 1914. 13

Business Opportunity

For Sale—Woodworking shop fitted especially for general work such as interior trim, doors, sash, etc. New and up-to-date machinery. First class dry-kiln. Blower system. Railway siding. Situated in a thriving Ontario town. Splendid local and shipping trade.

This is an exceptional chance to buy a bright business with a trade already established.

Write to J. A. C., care Contract Record, Toronto. 13

Tenders for Sidewalks

Sealed tenders will be received by Mr. C. M. Webber, Town Clerk, for the construction of sidewalks for the year 1914, until 4 p.m. on **Thursday, April 16th, 1914.**

Specifications may be seen at office of Contract Record, 220 King Street West, Toronto. Specifications and all other information may be received at office of Town Engineer, Welland.

All communications seeking information regarding this work to be addressed to the Town Engineer.

Each tender must be accompanied with a certified cheque valued at 10 per cent. of total cost.

Tenders delivered after above hour and date for receiving shall be disqualified.

The Council do not bind themselves to accept the lowest or any tender.

By order of the Street Committee,

A. E. MASON, Chairman.

Engineering Department,
Welland, March 23rd, 1914. 12-13

Notice to Contractors

Tenders will be received by registered post only addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, April 14th**, for the construction of the following sewers, viz.:

Claude avenue, from Queen street to Merrick avenue; Edgewood avenue, from Hemlock ave. to Small street; Glenmanor drive, from Queen street to south limit, lot No. 11; Glenmanor drive west, from south limit, lot No. 11, to Williamson road; Innes avenue, from McRoberts avenue to G. T. R.; Melgund road, from Bathurst street to Wells Hill avenue; North Toronto grade separation, from Dupont street and Ossington avenue, to 100 feet north of C. P. R. on Shaw street, via Dupont street and Shaw street; Paton road, from Lansdowne avenue to G. T. R.; Queen Street from Indian Road to east limit, lot No. 141; Scarborough road, from Queen street to Kingston road; Windeat street, from Woodville avenue to Indian road crescent.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tender obtained, at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tenders the names of two sureties (approved by the City Treasurer), or in lieu of said sureties, the bond of a guarantee company, approved as aforesaid. Conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, March 27, 1914. 13

For Sale

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.

The Jenckes Machine Company, Ltd.,
6-19 Sherbrooke, Que.

Asphalt Plant

Sealed tenders will be received up to 4 p.m., **Thursday, April 30, 1914**, for a semi-portable asphalt plant for the Corporation of the city of Victoria, B.C. Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted. 11-15

Steam Rollers

Sealed tenders will be received up to 4 p.m. on **Monday, April 27th, 1914**, for an 8-ton Steam Roller, to be supplied to the Corporation of the City of Victoria, B.C.

Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted.

W. GALT,
City Purchasing Agent.
March 18, 1914. 12-14

Tenders for Dredging

Sealed tenders addressed to the undersigned, endorsed "Tender for Dredging, Port Burwell," will be received until 4 p.m., **Thursday, April 9th, 1914**, for dredging required at Port Burwell, Elgin County, Ontario.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of the filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin operations immediately after the opening of the Welland Canal in the Spring.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, 20th March, 1914

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—58016. [illegible]

Quarry For Sale

Granite Quarry equipped for crushing and shipping. Well located for local market.

Address, Box 993, Contract Record, Toronto. 12-13

Wanted Employment

Practical man with ten years' experience in Concrete Construction, Street Paving, Sidewalks, Reinforced Floors and Beams, would act as Foreman or Inspector. Also contracts taken for Mixing and placing Concrete. Box 2, Contract Record and Engineering Review, Toronto. 13

Second Hand Machinery For Sale

Offers will be received by the undersigned up to **Monday, April 20th, 1914**, for the purchase of the whole or any portion of the following Second-Hand Machinery, at the City Yards, Ross Avenue and Tecumseh Street, Winnipeg.

One 90 h.p. upright Steam Boiler and 50 ft. Smokestack.

Forty-eight wheeled Scrapers.

One 12 h.p. Vertical Gasoline Engine.

One 8 h.p. Vertical Gasoline Engine.

One Drake Concrete Mixer, operated by 16 h.p. Gasoline Engine.

One ½ cubic yard Chicago Mixer operated by Electric Motor.

One Non-reversible Hoist operated by 15 h.p. Vertical Steam Boiler.

Each bid must be accompanied by an accepted cheque or cash deposit for a sum equal to 10 per cent. of the total amount of same.

The highest or any offer not necessarily accepted.

M. PETERSON, Secretary.
Board of Control Office,
Winnipeg, March 20th ,1914. 12-13

Welland Needs 500 More Houses

Owing to the fact that several additional industries are under construction in Welland at the present time, which when completed will require the services of several hundred additional workmen, and,

Owing to the fact that Welland is becoming a very large manufacturing centre by constant increase in its list of manufacturing industries, and

Considering that construction on the new Welland Ship Canal is about to be undertaken,

WELLAND NEEDS 500 MORE HOUSES
DURING 1914

The demand for workmen's homes within the limits of Welland is not only a present but a constantly growing one, and Welland has reached a point in its development where investment of money on a large scale in the building of houses is not only safe but profitable.

We the undersigned therefore invite Investi- [illegible] ers and investors and will gladly furnish par- [illegible] Welland's housing problem

JOHN GOODWIN,
Mayor of Welland

W. J. HICKEY,
12-13 Pres. Board of Trade

Free Dump

Contractors may dump clean earth on a site near Bloor and Sherbourne streets. Apply to Box 3, Contract Record, Toronto. 13

Wanted Employees

Architectural Draughtsman, with at least three years' experience. Speed and accuracy essential. State age, experience, references and salary last received. Apply by letter only, The Metallic Roofing Company, Toronto. 13

Agents Wanted

Large Indiana firm making concrete mixers wants representatives throughout Canada. Write stating territory you can handle. Best line of mixers in the U. S. A. Box 4, Contract Record, Toronto. 13

Residences

(Continued from page 81)

Outremont, is taking tenders until April 15th, on brick, roofing, plastering, painting, heating, plumbing and electrical in connection with the erection of 7 residences on Hampton St.

Montreal, Que., Outremont

Tenders for general contractor and separate trades on the erection of a residence on McCullough St., for J. C. Walsh, Board of Trade Bldg., are invited by Saxe & Archibald, architects, Beaver Hall Hill, Montreal.

Plans for the erection of a $75,000 apartment house on Bernard and Querbes Sts., for H. Blais, Ahuntsic, are being drawn by Doucet & Morissette, architects, 360 St. Catherine E., who invites tenders for separate trades.

Plans for the erection of 2 residences, at a cost of $30,000, are being drawn by Saxe & Archibald, architects, Beaver Hall Hill, Montreal.

Montreal, Que.

Permits have been issued to A. Laflamme, for flats on Delorimier St., $7,000; J. A. Duval, for flats on Girouard St., $16,000; Jos. Frenette, for flats on St. Jerome St., $5,500; B. Bass, for flats on St. Dominique St., $7,000; S. A. Derepentiguy, for flats on Crescent St., $5,000; S. Bartilini, for flats on Cavillier, $5,000; Charbonneau & Tremblay, for flats, on Hochelaga and Iberville Sts., $15,000; Jos. Deslauners, for flats on Drolet St., $9,000; Louis Latulippe, for flats on Lacasse St., $6,000.

Ottawa, Ont.

The erection of a residence on Wilbrod St., at a cost of $7,500, is being considered by W. Shenkman, 306 Frell St.

Plans for a solid brick residence on Daly St. are being prepared for Chas. A. McCool, 445 Wilbrod St., estimated cost $9,000. W. E. Noffke, Central Chmbrs., is the architect.

Quebec, Que.

A permit for the erection of a residence, at a cost of [illegible] has been issued to Ferdinand [illegible] Ave.

Regina, Sask.

Tenders will be received by Chas. S. Gladwell, Dom. Trust Bldg., [illegible] 4th, for the erection of a [illegible]

[illegible] house. Plans, specifications and price to be submitted.

Revelstoke, B.C.

Plans for a residence on McKenzie Ave., for Mr. Leonard Howson, are being drawn by W. H. Wallace, architect. Tenders are not yet called.

Sandwich, Ont.

Tenders for the erection of a residence for Rev. D. H. Hind, will be received by G. Jacques & Co., architects, Windsor, until April th. Estimated cost $5,000.

St. Marys, Ont.

Plans for the erection of a residence, at a cost of $6,000, are being drawn by Hayes Bros., architects, Wellington St.

Toronto, Ont.

Tenders on a residence and garage, on Ozark Cres., will be received by Bishop R. C. Evans, 35 Huron St.; the excavating is finished. Architect, J. H. Stanford, Bloor and Ossington.

Plans for the erection of a detached residence and garage on Lamport Ave., have been drawn by C. P. Band, 36 Toronto St.

Plans for the erection of 5 pair residences, on Dufferin, at a cost of $20,000, have been drawn by A. W. Pennock, 5 Burlington Cres.

Plans for the erection of 2 pair residences, on Fulton Ave., at a cost of $12,000 have been drawn by S. J. McClelland, 11 Fairview Blvd.

Dr. A. A. Macdonald, 12 Bedford Rd., has leased a site at the Island with 49 ft. 6 in. frontage, for the erection of a residence.

J. M. Cowan, 65 Adelaide E., invites tenders on all trades in connection with the erection of an apartment house on Tyndall street.

F. H. Miller, Lauder Ave., proposes to erect a $6,000 brick residence on Dufferin street.

John Hallam, 111 Front St. E., has leased a site at the Island with 99 ft. frontage, for the erection of a residence.

Plans for a $6,000 residence on Benlamond, have been drawn for Dr. H. E. Watson, 155 Main St., who will be ready for tenders after April 1st. Architect, E. S. Petersen, 273 Main St.

Tenders on the erection of an apartment house, on College St., near Shaw St., are invited by J. H. Haffa, architect, 209 Peterkin Bldg.

Tenders for masonry on the erection of a residence in Lawrence Park, are invited by D. E. Smith, architect, 27 Adelaide W.

Tenders on all trades connected with the erection of an apartment house are invited by Consolidated Building & Supply Co.

Plans for the erection of 2 pair residences, on Browning Ave., have been drawn for A. & A. Grant, 837 Logan Ave.

Vancouver, B.C.

A permit for the erection of an apartment house, on Broadway and Scott Sts., at a cost of $15,000, has been granted to J. J. E. McCague, 2560 York St. Architect, B. Dudley Stuart, 1009 12th Ave. E.

Winnipeg, Man.

Tenders on the erection of an apartment block, on Beverley St., are invited by Paul M. Clemens, architect, 331 Garry St. Estimated cost $35,000.

Tenders on the erection of 2 apartment blocks, on Sherbrooke St., are invited by T. L. Kerr, architect, 1006 McArthur Bldg.; estimated cost $110,000.

Tenders on the erection of an apartment block, on Chestnut, are invited by Jordan & Over, Canada Life Bldg.

CONTRACTS AWARDED

Hamilton, Ont.

The following contracts have been awarded in connection with the erection of J. H. Horning's residence on Maple Ave. Mason, Smith Bros., 270 Cannon St. E.; tinsmith, V. Drew, 261 Cannon St. E.; plastering, Hannaford Bros., 232 Robinson St.

Oak Bay, B.C.

The contract for the erection of H. G. Lawson's residence has been let to A. H. Mitchell. Architect, S. Maclure, 744 Hastings St. W., Vancouver.

Ottawa, Ont.

The contract for masonry in connection with the erection of a residence for P. W. Joyce, 126 Spadina Rd., has been let to Toms & Copeland, Arlington St.

The contract for the erection of an apartment block on Besserer St., for Leon Petregorsky, 229 Charlotte St., has been let to J. Younghusband, Spruce St.

Pembroke, Ont.

The following contract has been awarded on the erection of Judge A. Fisher's residence, on Supple Street. Carpentry, F. Fischer. Architects, Horwood & Taylor, 120 Sparks Street, Ottawa.

Quebec, Que.

A contract for the erection of a residence, for Jos. Bedrod, 216 Queen St., has been let to J. B. Verrch, 184 3rd Ave., Limoilou.

Sherbrooke, Que.

The contract for the erection of a residence for N. De Cascadden, 90 Laurier Ave., has been let to C. T. Turner, Sherbrooke.

Toronto, Ont.

The contract for masonry connected with the erection of a detached residence on Crown Park Rd., for L. A. DeLaplante, 1432 Queen E., has been let to Brown Bros., 510 Yonge St. Other trades are not yet awarded. Architect, J. P. Hynes, 199 Yonge St.

The following contract connected with the erection of a detached residence on Leslie St., for Rev. F. F. Rohleder, have been let. Mason, John McGlue, 285 Sherbourne St.; carpentry, M. J. Madden, 62 Wilson Ave.; tenders are in for other trades. Architect, A. W. Holmes, 10 Bloor St. E.

The following contracts on the erection of a duplex residence, on Glen Rd., for C. W. Defoe have been let. Architects, S. B. Coon & Son, Temple Bldg.; mason, A. Webb, 13 Shirly St.; carpentry, J. M. Davis & Son, 49 Muir Ave.; painting, Jas Phinnemore, 445 Yonge St.; plumbing and heating, C. J. Tyler, 20 Price St.; wiring, Windeler Bros., 603 Yonge St.; iron, W. G. Miller, 589 St. Clarens, Ave.; plastering, Sparks & Son, 188 Sorauren Ave.; tiling, T. Eaton & Co., Yonge St.

Winnipeg, Man.

The contract for the erection of Mr. R. Scott's residence, on Ruskin Row and Kingsway, has been awarded to J. McDiarmid Co., Canada Bldg. Architect, J. N. Semmens, 9th Floor, McArthur Bldg.

Power Plants, Electricity and Telephones

Prov. of Alberta

The C. P. Telegraph Co., Ltd., propose adding the following transmission lines (1) 27 miles S.W. of Suffield; (2) Lacombe branch, 77 miles; (3) N.W. of Coronation, 25 miles; (4) N.E. of Bassano, 150 miles.

Edmonton, Alta.

The Public School Board contemplates installing electric firm alarms in certain schools.

Moose Jaw, Sask.

The Moose Jaw Electric Rly. propose to extend the street railway from Main St. eastward on Hall St. for one-half mile. The work to start as soon as material is received. The city will ask the company to build further extensions.

Morse, Sask.

The town has been authorized to raise the sum of $2,500 for street lighting purposes.

Pt. Burwell, Ont.

The projected radial railway to London has been abandoned.

Swift Current, Sask.

The city has been authorized to raise funds to purchase a site for an electric lighting and power plant.

Ste. Agathe des Monts, Que.

Tenders will be received by Rodolphe Daze, Sec.-Treas. to the Council, until 8 p.m. April 6th, for the supplying and construction of an Hydro-electric Development. Plans and specifications at office of Engineers, Ouimet & Lesage, 76 St. Gabriel street, Montreal, and at office of the Secretary-Treasurer.

Wilkie, Sask.

The town has been authorized to raise the sum of $5,000 for extension to the electric lighting plant.

Windsor, Ont.

The construction of a street railway to connect Windsor, Sandwich, Walkerville and Ford City, is proposed.

Woodbridge, Ont.

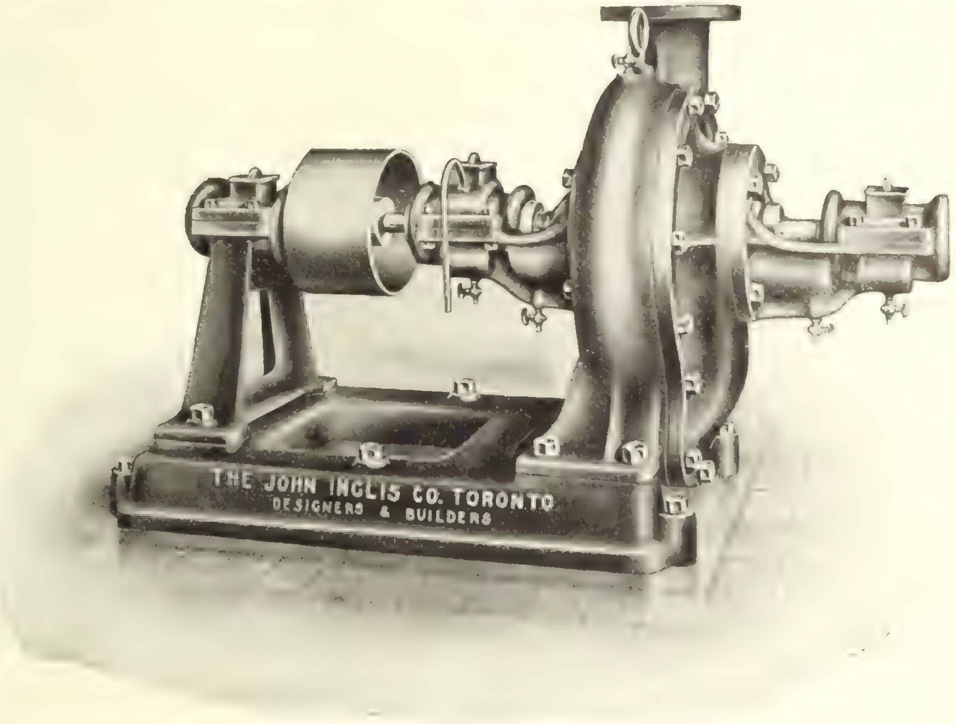
A vote is to be taken on April 11th for authority to raise the sum of $6,000 for the installation of hydro power.

CONTRACTS AWARDED

Edmonton, Alta.

The Supt. of the Electric Lighting Dept. recommends the following contracts:—(a) 2,500 ft. No. 6 B & S Twin conductor, paper insulated, leaded cable, 10,000 volts W.P. to the Siemens Co., Ltd. Price f.o.b. Edmonton, $476; (b) 16,500 ft., No. 6 B & S twin conductor, paper insulated, leaded band armoured cable, 10,000 volts W.P. to the Siemens Co., Ltd. Price f.o.b. Edmonton, $4,957; (c) 2,500 ft. No. 4—0 B & S 3 conductor, paper insulated, lead covered cable, 6,600 volt W.P. To Eugene Phillips Electri-

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

cal Works. Price f.o.b. Edmonton, $1,-[illegible]

Winnipeg, Man.
The following contracts for line materials have been awarded by the City Council. Northern Elec. Co., Ltd., Win[illegible] wire, splicing compound, forked service insulators, oak side brackets, Pierce brackets, soldering paste, glass and porcelain insulators. Canadian General Elec. Co., Ltd., Winnipeg.—Primary cut-outs, fuse wires, galvanized eye bolts, mica weatherproof lamp sockets, conical strain insulators, galvanized machine and carriage bolts. Mainer Elec. Co., Winnipeg.—Split porcelain knobs, porcelain clamp insulators, wooden pole steps, porcelain wall bushings, porcelain strain insulators and [illegible] top pins.

Miscellaneous

Guelph, Ont.
The sum of $2,500 has been appropriated for the purchase of an auto truck apparatus.

Quebec, Que.
Tenders received by the Waterworks Engineer, J. Gallagher, City Hall, until 4 p.m. April 7th, for the years supply of pig lead, 25 tons or more; lead pipe, 10 tons or more; iron and brass castings, cement, brick and drain pipes.

Sherbrooke, Que.
The City Council proposes to construct a gas holder with a capacity sufficient to hold week's supply of gas, about 300,000 cu. ft., concrete base, steel plate construction.

St. Marys, Ont.
The Town Council is about to purchase the cement required for repairs to walks, roads, etc.

Toronto, Ont.
Godson Contracting Co., 113 Manning Chmbrs., require a second-hand equipment, including dump cars, 1 yd. and 2 yds.; clam shell derrick hoist, for excavating sewers and sand pits; dump wagons; Lackawanna or U. S. steel sheet piling.

Vancouver, B.C.
The estimates to be forwarded to the council include, fire boat $125,000; auto water tower $15,000; auto service truck $8,350; 2 auto pumping engines $25,000.

CONTRACTS AWARDED

Quebec, Que.
A contract has been awarded by the Public Works Dept., to Jobin & Paquet, 78 Cote d'Abraham, for the installation of a Reichel automatic fire alarm signal system in the Parliament Bldgs.

Windsor, Ont.
he London Concrete Machinery Co., Ltd., London, have secured the contract to furnish, one ½-yd. Batch mixer, also barrows, concrete carts, for the erection of the Central Ice & Storage Co.'s Plant. Thomas L. Humphries, contractor.

Business Notes

Painswick, Ont.
St. Paul's Church was recently destroyed by fire, the loss is between $6,000 and $7,000. It has been decided to rebuild.

St. John, N.B.
The warehouse of F. de L. Clements, Coburg St., has been destroyed by fire. The loss $7,500 was partially covered by insurance. Rebuilding is contemplated.

Toronto, Ont.
The Woodbine Hotel, on King St. W., has been gutted by fire, the contents being completely destroyed. The loss is estimated at $150,000, $135,000 of which is covered by insurance.

The planing mill of the Laidlaw Lumber Co., Eastern Ave., was recently destroyed by fire. Loss $50,000; insurance, $40,000.

New Companies

Masson, Limitee, has been incorporated with a capital of $50,000, with head office at Quebec, to carry on business as metal merchants. The provisional directors are D. Masson, J. B. H. Lamere and L. J. Loranger, of Montreal, and A. D. Masson and J. Masson, of Quebec.

John Adam, Limited, has been incorporated with a capital of $75,000, with head office at Montreal, to carry on business as general contractors. The provisional directors are G. L. Alexander, H. Caulfield, A. T. Paul and H. Hughes.

The Stanworth Power Co., Ltd., has been incorporated with a capital of $250,000, with head office at Toronto. The provisional directors are W. J. Simpson, S. W. Hall, R. E. W. Duke, A. Wales and H. G. Hammond, all of Toronto.

Builders and Contractors, Ltd., has been incorporated with a capital of $50,000, with head office at Winnipeg. The provisional directors are F. W. Smith, S. S. Smith, W. D. Macfarlane, J. Coupar and W. D. Robertson, all of Winnipeg.

Moosehorn Lime Co., Ltd., has been incorporated with a capital of $200,000, with head office at Winnipeg. The provisional directors are F. K. Hamilton, W. Martin, J. Galloway, and N. J. D'Arcy, all of Winnipeg.

The Pioneer Heating and Plumbing Co., Ltd., has been incorporated with a capital of $20,000, with head office at Humboldt, Sask.

Western Canada Lumber and Building Co., Ltd., has been incorporated with a capital of $300,000, with head office at Saskatoon, Sask.

Western Canada Steel Co., Ltd., has been incorporated with a capital of $25,000, with head office at Regina, Sask.

J. Z. Lajoie Co., Ltd., has been incorporated with a capital of $2,000,000, with head office at La Joie Falls, B.C., to carry on business as a general power company.

Port Coquitlam Builders' Supply Co., Ltd., has been incorporated with a capital of $10,000, with head office at Port Coquitlam, B.C.

The Sand Mixing Machine Co. of Canada, Ltd., has been incorporated with a capital of $50,000, with head office at Brantford, Ont. The provisional directors are N. D. Neill, M. Macpherson, J. G. McKay and F. Bell, all of Brantford, Ont.

Canadian Home Construction Co., Ltd., has been incorporated with a capital of $40,000, with head office at Windsor, Ont. The provisional directors are C. B. Storer, E. J. Northwood and F. R. Cook.

Vancouver Cedar Mills, Limited, has been incorporated with a capital of $750,000, with head office at Vancouver, B.C., to carry on business as lumber merchants.

Lake Shore Sand and Gravel Co., Ltd., has been incorporated with a capital of $250,000, with head office at Toronto. The provisional directors are A. A. Miller, G. T. Denison, Jr., and R. S. Smith.

ERIE
Barrows
Made for
Every Purpose

Strong,
Durable,
Light
Construction

The Erie Iron Works, Limited - St. Thomas, Ontario

CONTRACTORS' EQUIPMENT

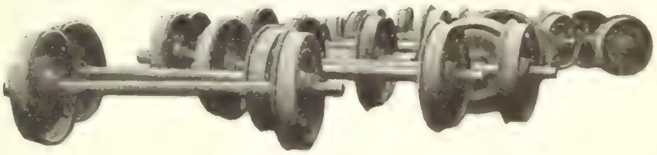
Steam Hoists, Electric Hoists, Horse Powers, Belt Hoists, Hand Winches, Derricks, Car Wheels, Axles and Boxes, Dump Cars, Rail Cars, Buckets, etc.

Do not wait for the **Spring** rush, order **now** and have your plant ready for an early start.

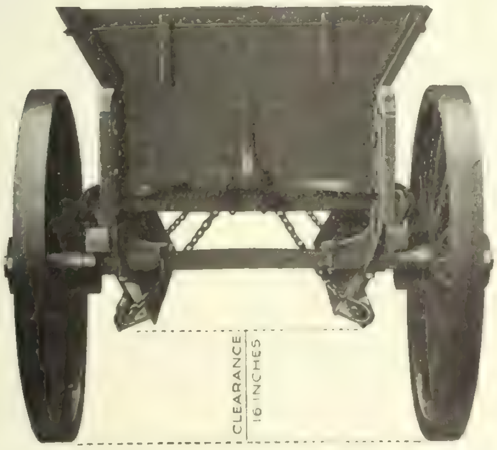
Marsh & Henthorn, Limited - Belleville, Ont.

Makers of Hoisting
Machinery

Sales Agents—
Mussens, Limited,
Montreal, Que.



Have You Ever Seen



a dump wagon that was ten years old, that wasn't a Watson? We doubt it.

Look round a bit. You will find it a real job to find one five years old, and still running, unless it's a Watson. Try it.

John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.

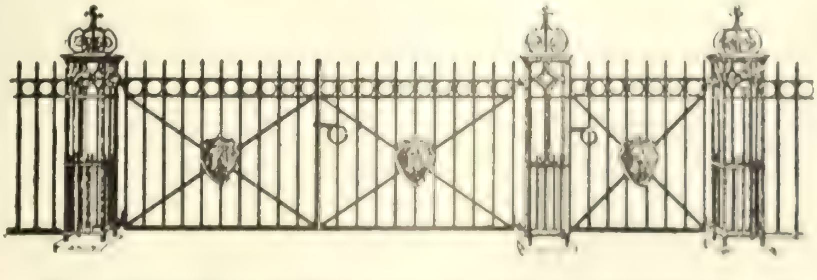
Buy the Brick
of
Proven Merit

By actual use in many structures and by scientific tests Harbour sand lime bricks have been proved an ideal building material.

Tests made at the University of Toronto at different times showed the crushing strength in pounds per square inch as: 4180, 4020, 4050, 4130. This is proof of uniformity in strength.

Harbour Brick Co., Limited
50 Front Street E.
Toronto

Iron Fence and Grill Work



If you have any special designs, monogram [illegible]

Prices and Particulars cheerfully furnished

WE ALSO DO IRON STAIR WORK

The Geo. B. Meadows
Toronto Wire, Iron & Brass Works
Co., Limited
TORONTO, - ONT.
Meadows Block, Wellington St. West

The BEST Results in Painting

are obtained from

Special Paints made **Specially** to meet **Special Conditions**

A Paint made to give the best possible results on ALL kinds of surfaces cannot (the fact is self evident) give the same protection that a paint ***made specially to protect ONE special surface*** will give.

SPECIAL PAINTS ARE OUR SPECIALTY

If You Contemplate the Painting of:

- BRIDGES
- BUILDINGS
- GAS HOLDERS
- STEEL CARS
- STRUCTURAL STEEL
- STACKS and BOILERS
- ROOFS (metal or canvas)
- GRAIN ELEVATORS
- TANKS
- PENSTOCKS
- PIPING
- TROLLEY POLES

We shall be glad to tell you of these Special Coatings
They will REDUCE YOUR MAINTENANCE COST

DOMINION PAINT WORKS, LIMITED

Montreal
Toronto

WALKERVILLE, ONT.

Winnipeg
Vancouver

Made in U. S. A. by DETROIT GRAPHITE CO., Detroit, Mich.

TENDERS FOR WORK

We would be pleased to submit prices on timbers of any description for building,

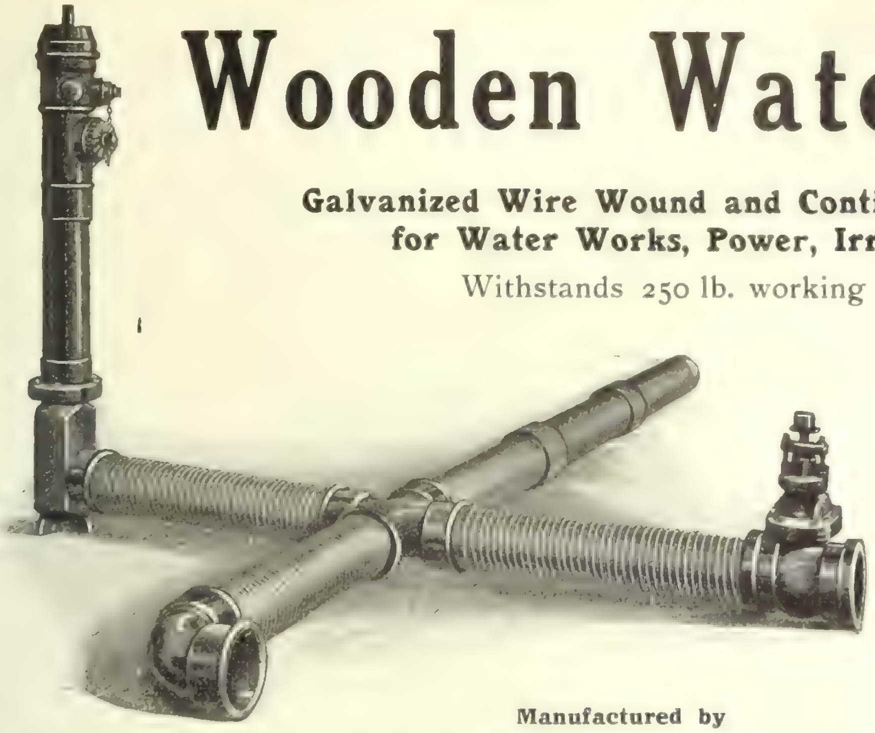
Tugs Dredges Scows
Wharves Coal Shoots or Piling

It would be entirely to your advantage to have competitive prices on your requirements, and to have our prices even if only as a matter of record.

OUR MILLS RUN ALL WINTER.

JAMES SHEPPARD & SON

SOREL, QUE.



Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915

Factory: 550 Pacific St., VANCOUVER, B. C.

Another Big Contract

The new plant of the Northern Aluminum Company, Toronto. The contract for roofing and sheet metal was executed by us

We specialize in

The Built up Pitch, Felt and Gravel Roofing, Damp-proofing Foundations, Slating, etc.

We also manufacture

SKYLIGHTS, CORNICE, FIRE DOORS AND WINDOWS, TIN CLAD DOORS, ASPHALTS, TARRED AND DRY FELTS, COAL TAR PITCH

We will quote you attractive prices on any of the above—write us.

REGGIN AND SPENCE

Roofing and Sheet Metal Contractors

530 Front Street West - Toronto

Lay 200 More Bricks Every Day

Hundreds of contractors to-day are laying 200 bricks more every day than they used to because they use

Renfrew Lime

in their mortar. It makes the mortar much easier to handle and it goes farther.

You can save 75 cents a day on every bricklayer by using our lime in your mortar.

Try "Renfrew" on your next job.

White Lime
Gray Lime
Drain Tile
Brick, Stone

Jamieson Lime Co.
Renfrew, Ont.

Keep the Work Going

Nothing is more important in contracting work than the prompt and certain movements of cars.

Delays affect the whole job. To avoid delays and insure maximum yardage, locomotives must be reliable and always ready for service.

Our Standard Contractors' Locomotives are built to insure reliability and constant service. Only tested materials are used in their construction. All wearing parts are made to templates and gauges. Interchangeability of like parts is guaranteed, and long delays waiting for duplicate parts avoided.

MONTREAL LOCOMOTIVE WORKS, LTD.

DOMINION EXPRESS BUILDING, MONTREAL, CANADA

This is Elmhurst Avenue, Highland Park, Mich.

A Modern Concrete Pavement

Equipped With Baker Armored Expansion Joints and Triangle Mesh Reinforcement

Do you know of all the epoch making advances in concrete road and pavement construction during the past year?

Write for our 1914 booklet and circulars—they are full of "up-to-the-minute-ideas" on concrete paving.

Baker Methods Always Lead

The R. D. Baker Co.

705 Whitney Bldg., Detroit, Mich.

THE TURNER MUSHROOM SYSTEM

View of Sears Roebuck Company Building under construction Dallas, Texas

REINFORCED CONCRETE FLAT SLAB CONSTRUCTION

(Patented)

The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

All infringers are being rigidly prosecuted, as Mr. Turner has in his employ at the present time five of the best known and most able firms of patent attorneys in the United States.

OWNERS, PROTECT YOUR OWN INTERESTS by demanding that your flat slab designers furnish an infringement bond of an amount equal to the cost of your building. Demand a bond for a five year term and make yourselves safe.

THE MUSHROOM SYSTEM

is the original reinforced concrete flat slab system and is the only legitimate flat slab on the market today.

For designs, estimates and suggestions embodying the best of our long experience you have only to consult our Engineers, without any obligation on your part.

Make the Concrete construction in your building secure by utilizing the long experience, right design and efficient service behind the Mushroom System.

C. A. P. TURNER

M. Can. Soc. C. E.

Consulting and Contracting Engineer

Main Office: 6th Floor, Walker-Burton Bldg., Minneapolis, Minn.

Canadian Offices

Winnipeg, Canada
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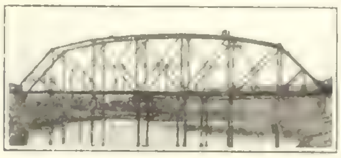

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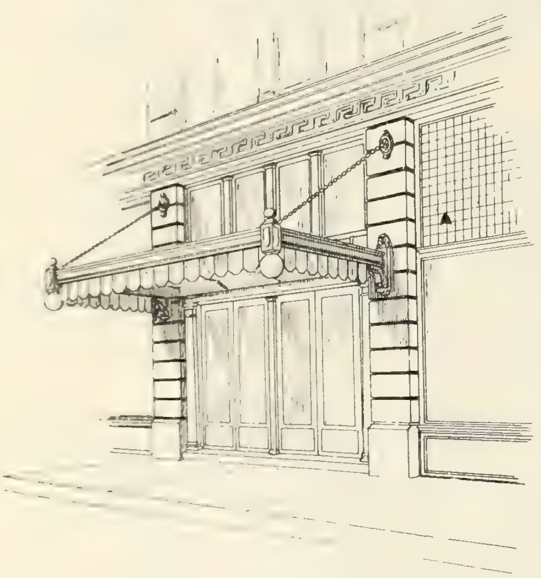

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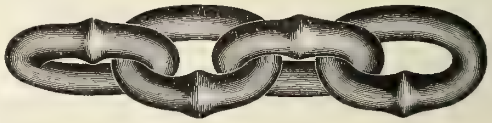

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Guaranteed to pull stiff before breaking and not to break at weld.

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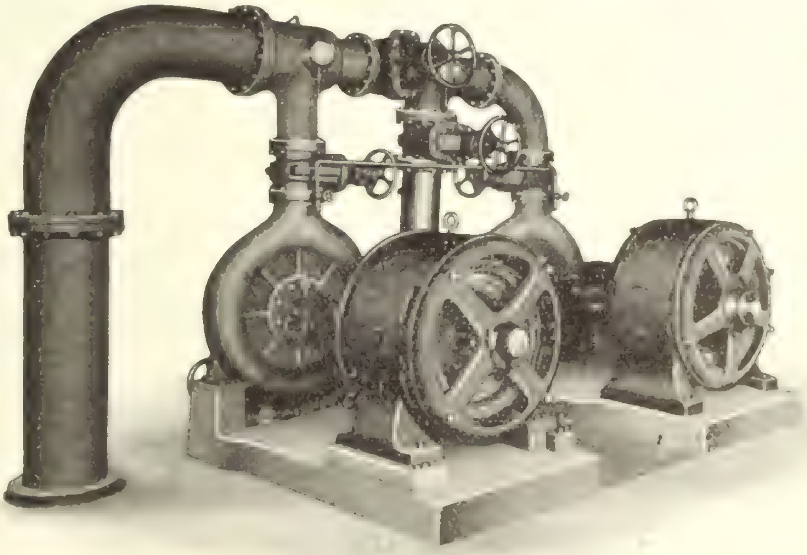

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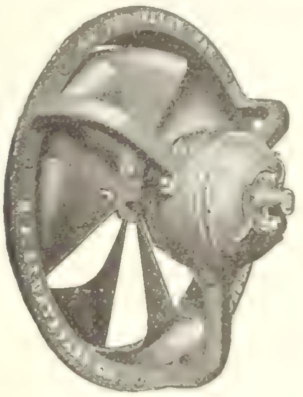

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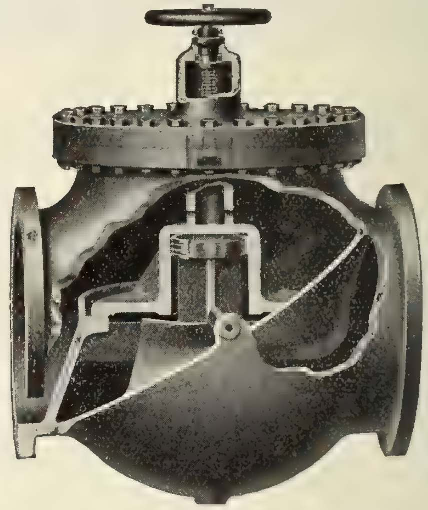

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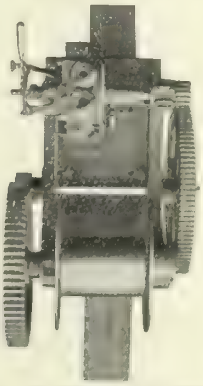

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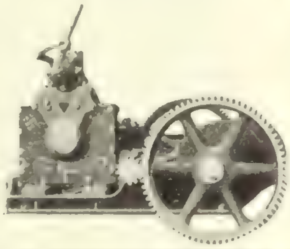

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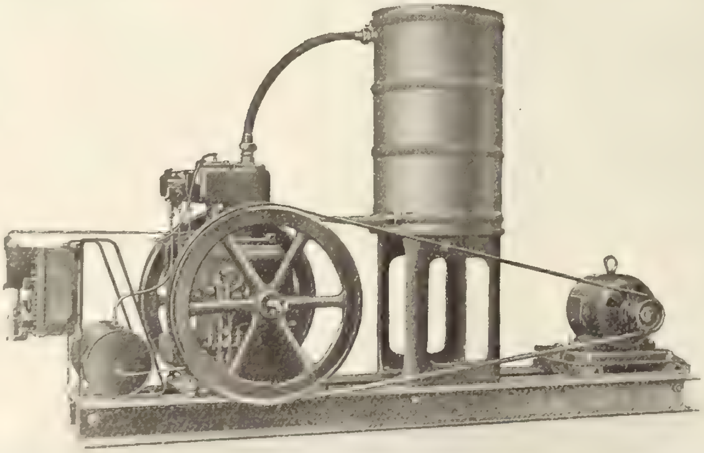

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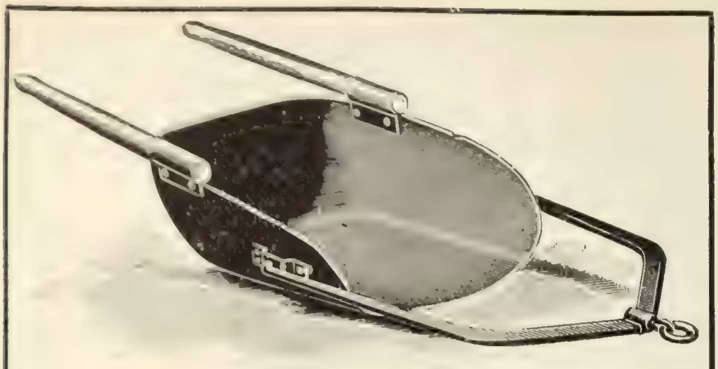

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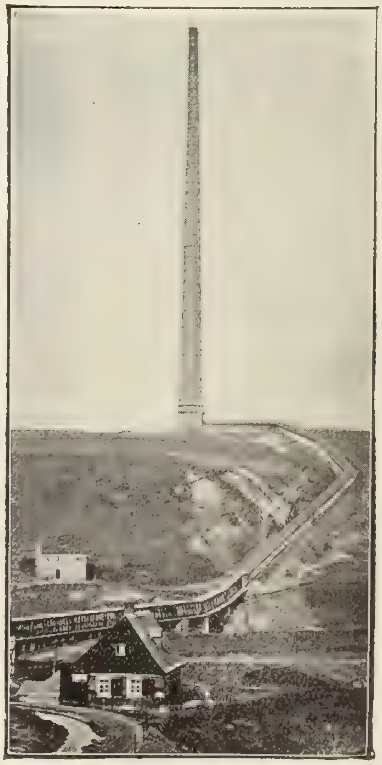

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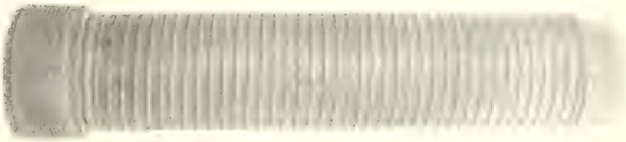

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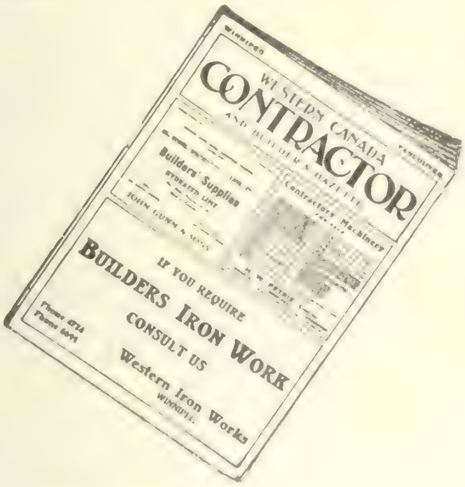

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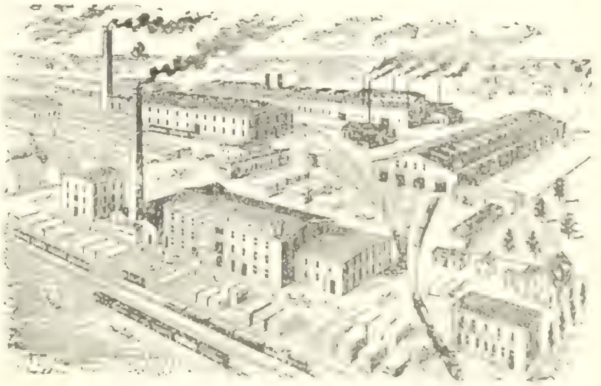

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Brick—No. 1 dry pressed red and buff brick, $18, common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick (a) $8.10, King Edward siding, (b) $10.50 delivered on the job.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.30; 1-in., $1.40; 3/8-in., $1.40; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

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Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.10, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

A private company called the Toronto and Hamilton Home Builders, Limited, has been incorporated in London, Eng., with a capital of $650,000 for the purpose of erecting artisans' houses in the cities named.

It is announced that the new works and plant of the B. C. Potteries, Limited, on Florence Road, Esquimault, B. C., replacing those destroyed by fire last September, have commenced operations. The company, which is one of the pioneer local industries of Victoria, makes a specialty of vitrified brick, flue lining, chimney pipe and partition tiles.

The Toronto Society of Domestic, Sanitary and Heating Engineers have made an offer (which has been accepted) to furnish complete equipment for the plumbing laboratory in the new Technical School, Toronto. The installation is intended to supply the senior classes in plumbing with a practical knowledge of all modern sanitary equipment and the method of installing it.

The paving programme outlined by Mr. W. N. Ashplant, city engineer of London, Ont., and approved by the city council, for construction this year, calls for an expenditure of about $130,000, made up as follows: asphalt, $100,000; brick, $20,000; concrete, $10,000. Contracts for storm sewer work to the amount of $150,000 will be let within the next few weeks and paving tenders will be called for at once.

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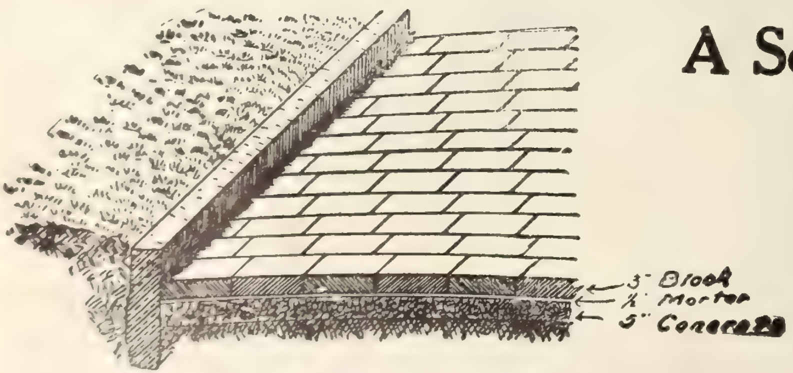

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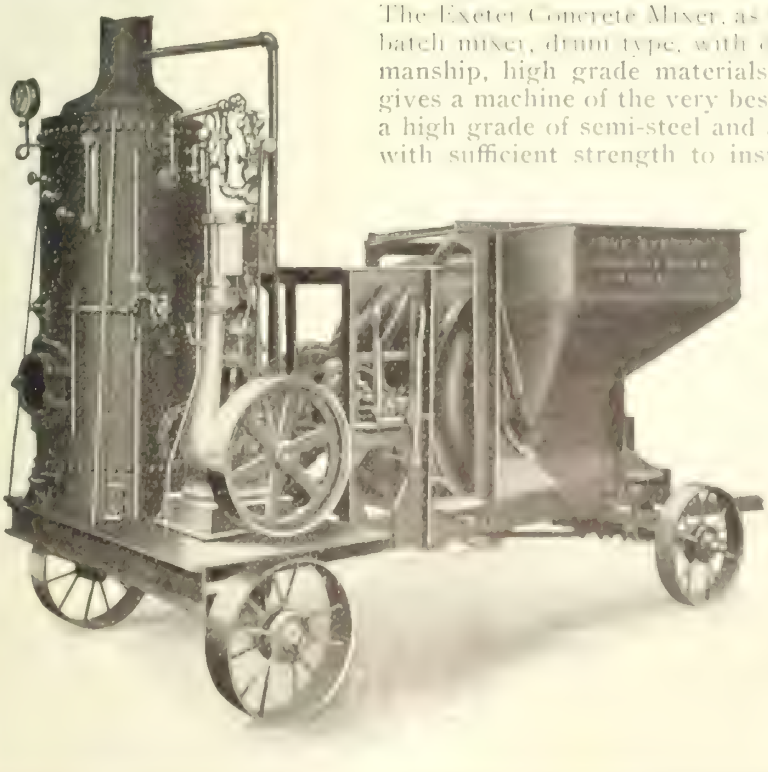

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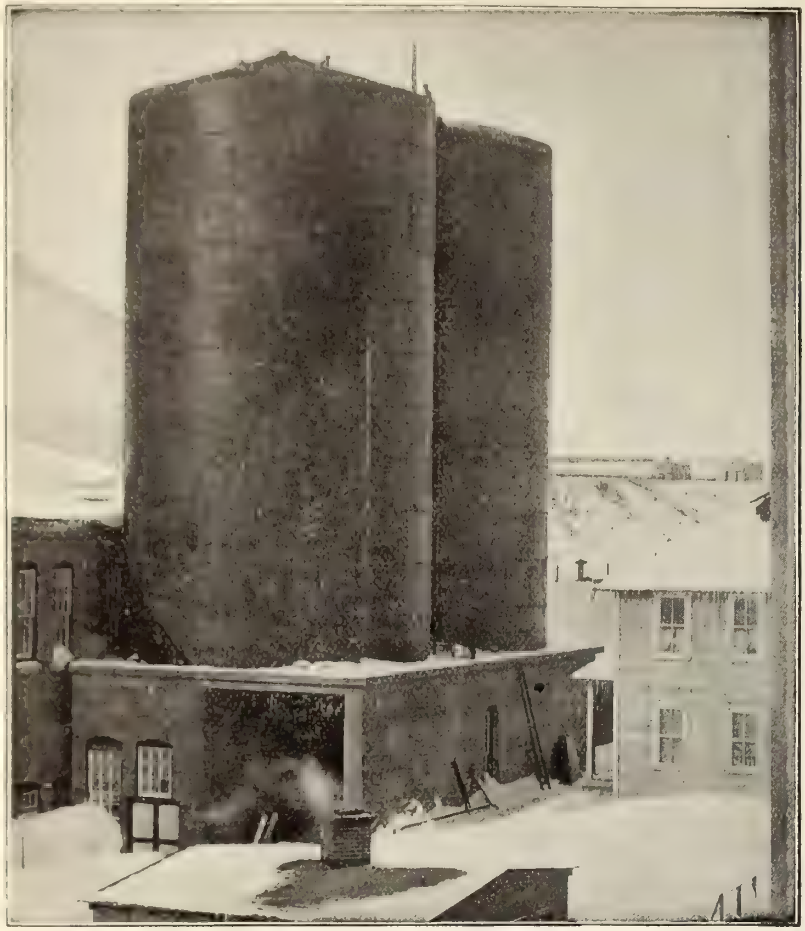

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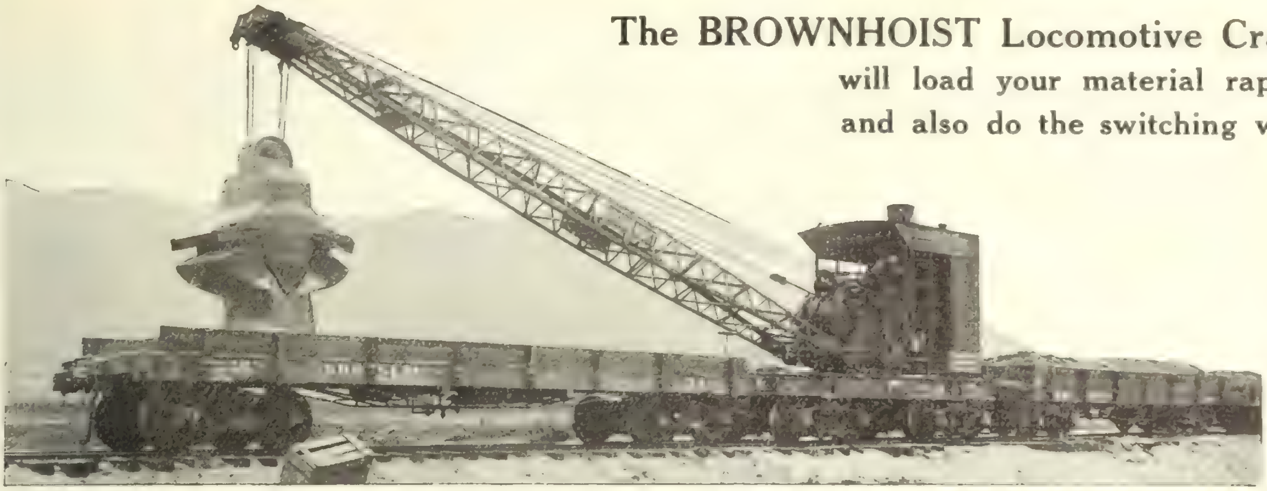

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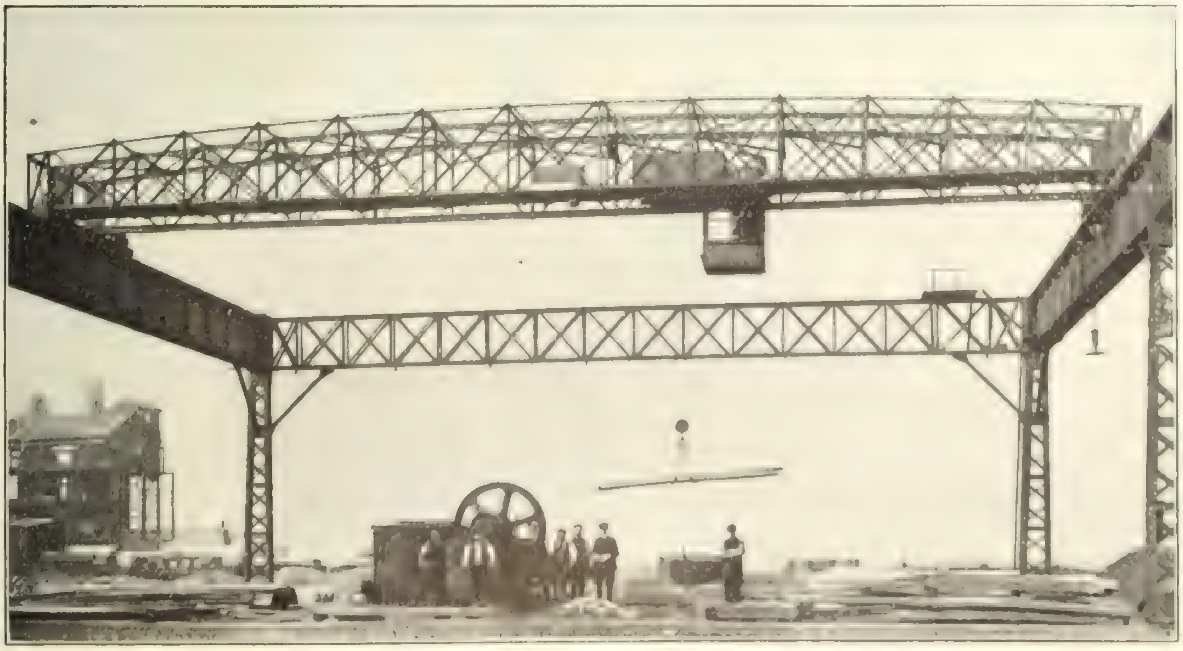

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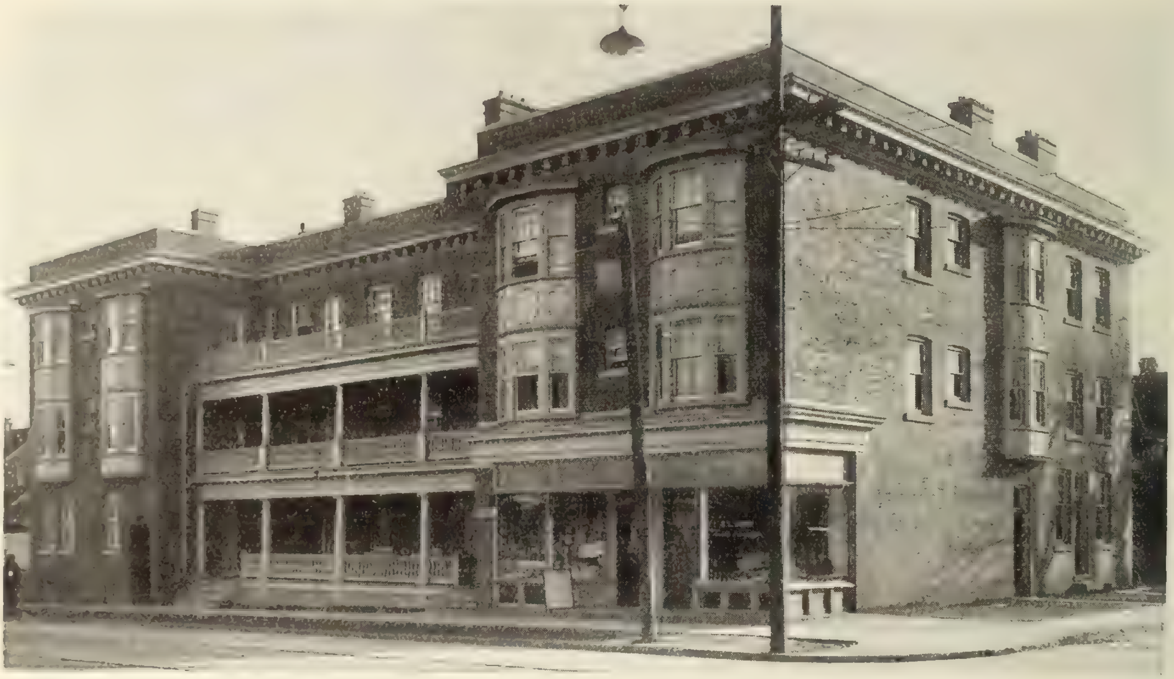

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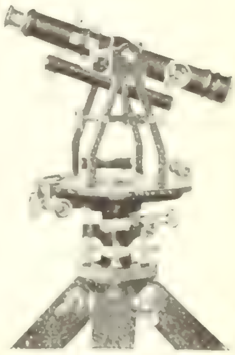

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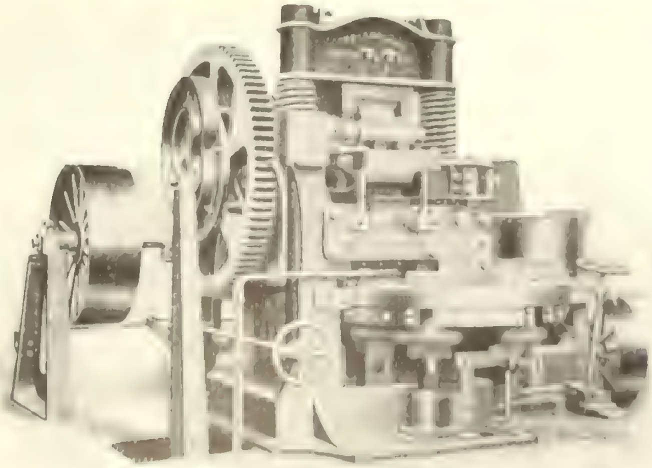

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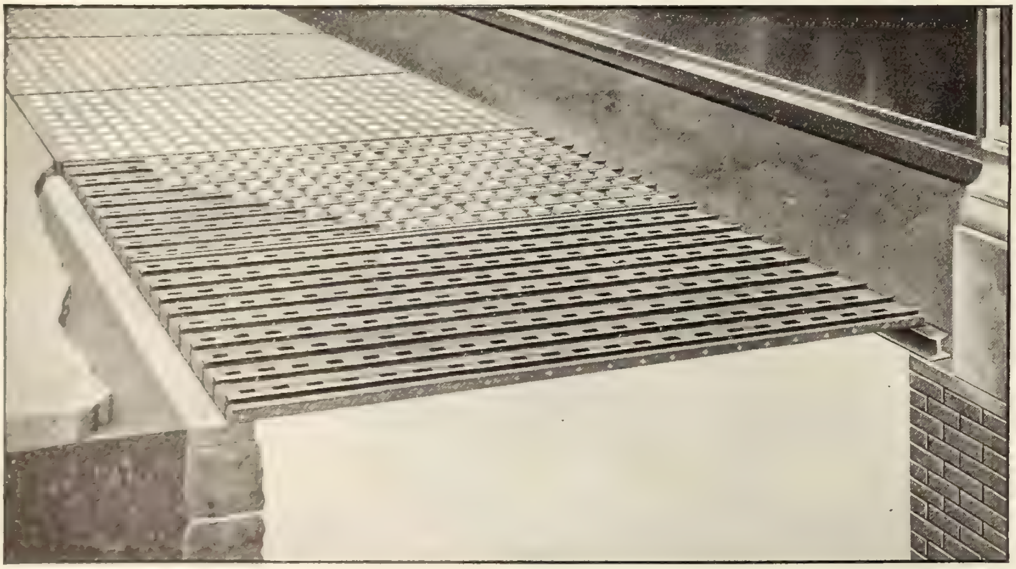

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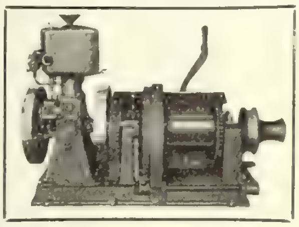

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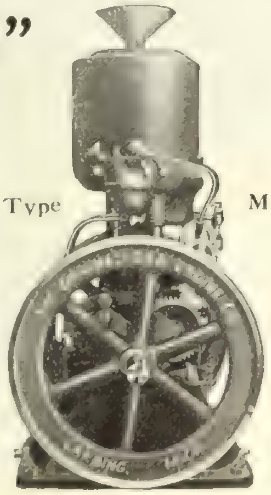

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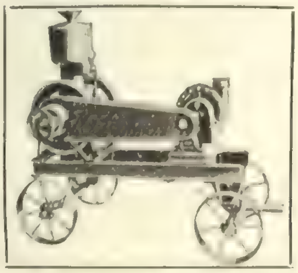

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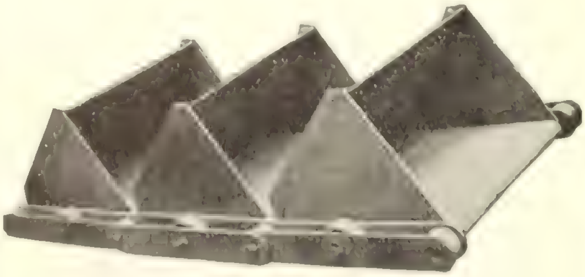

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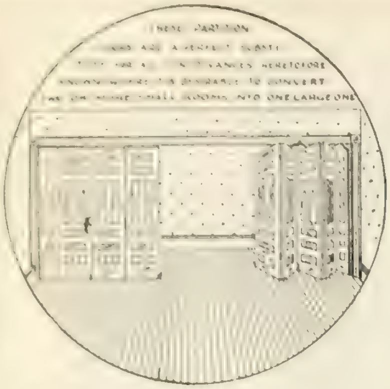

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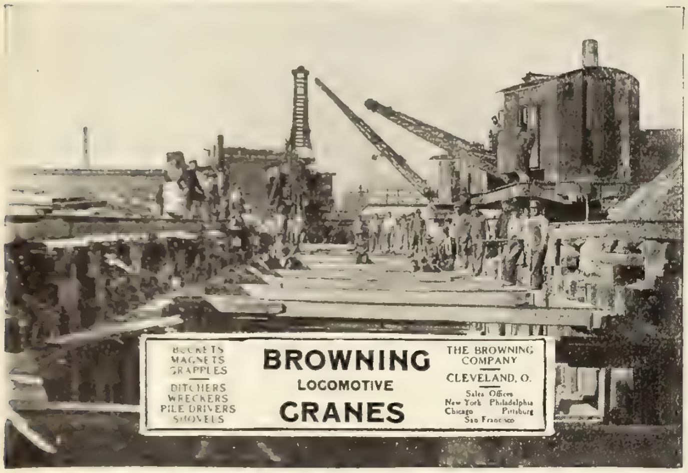

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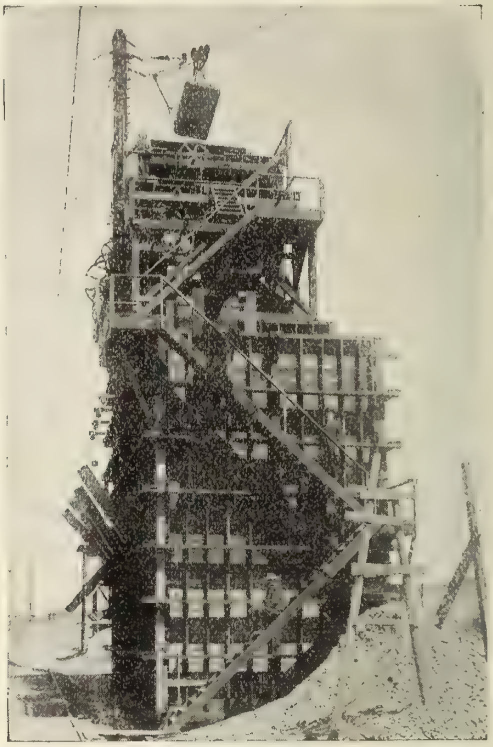

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We will be glad to send you our illustrated catalogue showing several "Dull" designed and erected plants.

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For Railway and Bridge Work, Contractors' and Builders' Use

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To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

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Has Become a Habit with Superintendents and Engineers.

The reason is not hard to find, for there is no part of your Belting system, from the main drive to the smallest light Belt for power transmission, where you will not get the best kinds of service from

"Maple Leaf" Brand Stitched Cotton Duck Belting.

It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

It is built of plies of selected duck.

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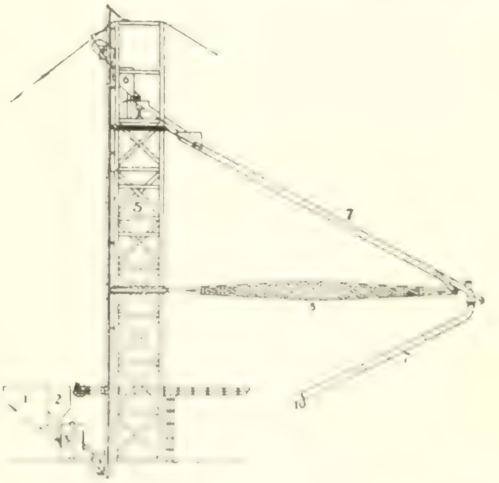
Hamilton, Canada



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A system that improves the concrete and reduces the cost.

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Tile and Insulation Are In One Piece

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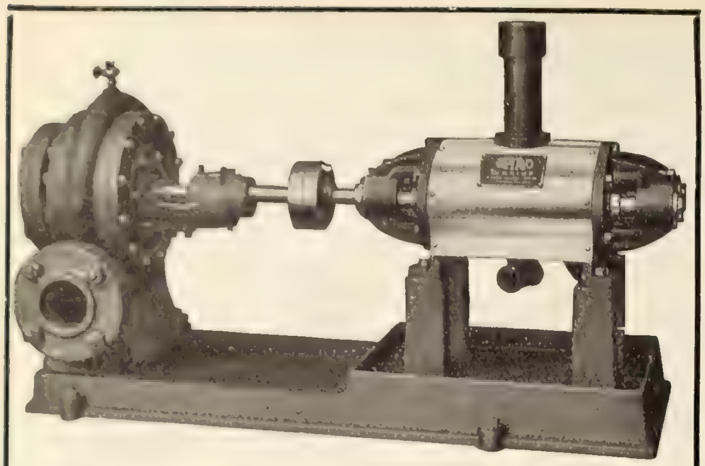

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Sewage Disposal in the United Kingdom, by Henry Lemmoin Cannon. Published in 1912 by St. Bride's Press, London, Eng. 320 pages; illustrated. Price $1.00.

Strength of Materials, by Edward H. Maurer. Published in 1908 by American School of Correspondence. 128 pages. Illustrated. Price 75c.

The Modern Asphalt Pavement, by Clifford Richardson. Published in 1910 by John Wiley & Sons, New York. 630 pages; illustrated. Price $2.00.

Text-Book on Highway Engineering, by Arthur H. Blanchard. Published in 1913 by John Wiley & Sons, Inc., New York. 762 pages. Illustrated. Price $3.00.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price $1.50.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price $1.00.

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Concretes, Cements, Mortars, Plasters and Stucco, by Fred T. Hodgson. Published in 1906 by Frederick J. Drake & Co., Chicago. 520 pages. Price $1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

Specifications for Street Roadway Pavements, by S. Whinery. Published in 1913 by McGraw-Hill Book Company, New York. 116 pages. Price 75c.

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Reinforced Concrete Construction, by George A. Hool. Published in 1912 by McGraw-Hill Book Company, New York. 254 pages. Illustrated. Price $2.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00.

A Treatise on Concrete Plain and Reinforced, by Frederick W. Taylor. Published in 1905 by John Wiley & Sons. 584 pages. Illustrated. Price $1.50.

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This building was wired with "30" PARA" Rubber Insulated Wire.

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All sizes for any practical gauge

We will be pleased to submit full particulars.

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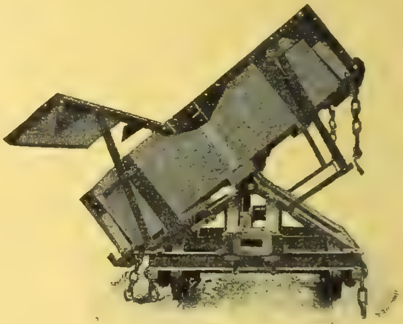

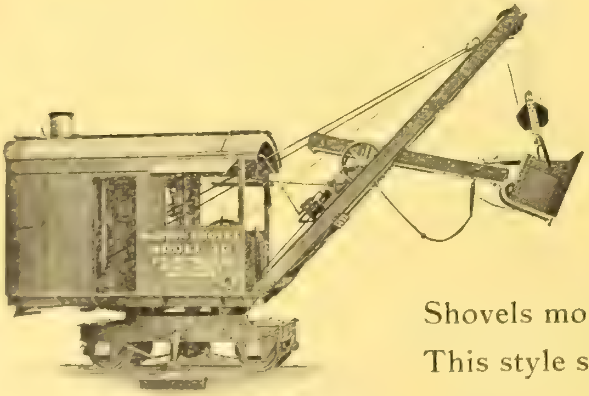

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Revolving Type

This type shovel is supplied in three sizes
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Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

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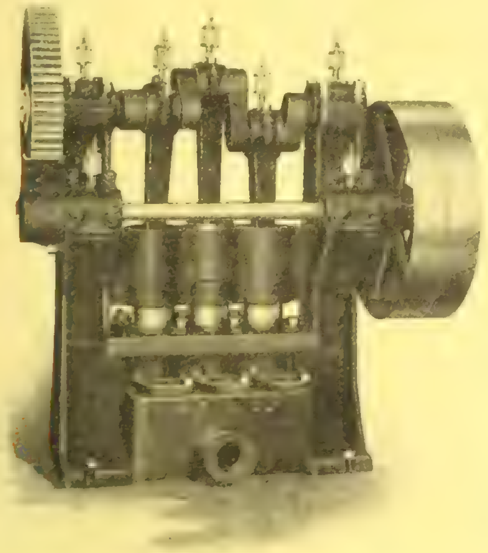

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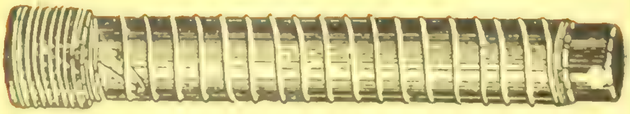

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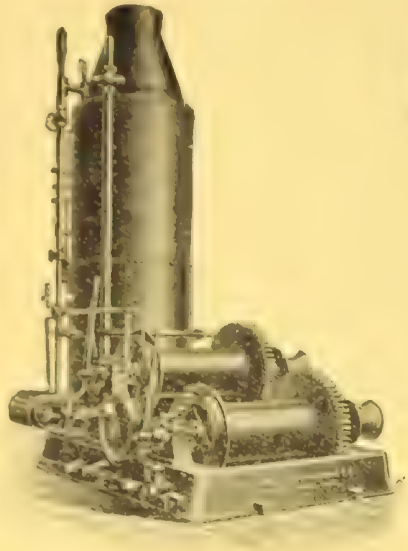

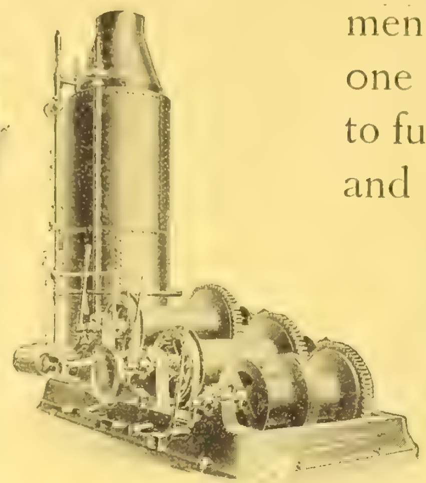

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With Single or Multiple Drums

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Each machine represents highest possible grade of material and workmanship.

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One man takes a chance, that's gambling; another buys "AMERICAN" Steel Derricks, that's good business, which is nothing but sound common sense.

Every possible stress and strain is covered by the carefully calculated and proportioned construction of these derricks.

An "AMERICAN" Fifty-Ton Steel Guy Derrick

is shown here working on the Hardaway Contracting Company's big hydro-electric power construction at Whitney, N.C. It is lifting a 96,000 pound casting of a Gates crusher. This derrick has a monster 5 sheave block—as tall as a man.

Greatest safety, longest service—You get them both when you buy "AMERICAN" Steel Derricks.

MADE BY

American Hoist & Derrick Company

ST. PAUL, MINN., U. S. A.

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It frequently happens that Architects or Engineers are called upon to design buildings—such as libraries, museums, club houses, park buildings, etc., in which one of the principal features is an artistic exterior. In cases of this kind no material lends itself to greater variety of treatment than does concrete. It can be moulded to any desired form and the surface given any one of a number of different and attractive kinds of finish.

A Striking Example

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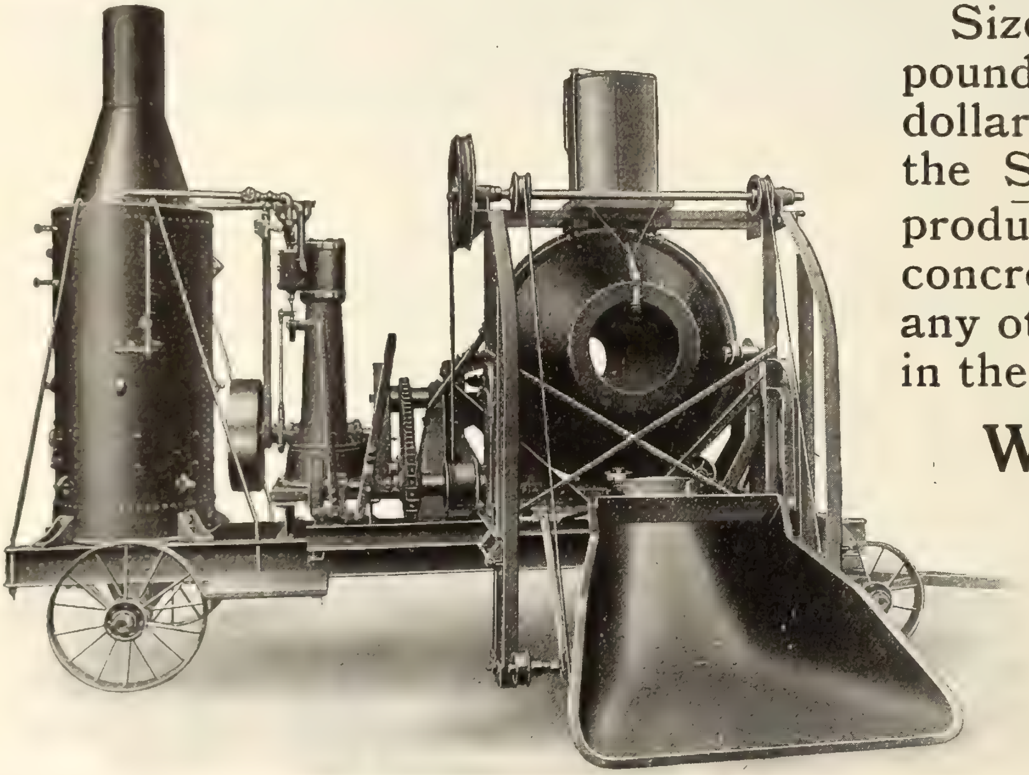
Architects, Engineers and Contractors, engaged in this class of work can obtain many useful suggestions for the artistic treatment of buildings as a whole and in detail by simply addressing their requests to

Canada Cement Company
Limited
887 Herald Building, Montreal

Concrete Facts
About a
Concrete Mixer

THE SMITH CONCRETE MACHINE is built to succeed, sold by results and judged on performance.



Size for size, pound for pound, dollar for dollar, the Smith will produce more concrete than any other mixer in the world.

WHY?

The big margin of superiority is in the design, the tilting drum, the shape of the drum, the end-to-centre motion of the mass, the central position of the drum ring and main rollers, the cradle support of the running gear—As well as the quality of material and workmanship entering into its construction.

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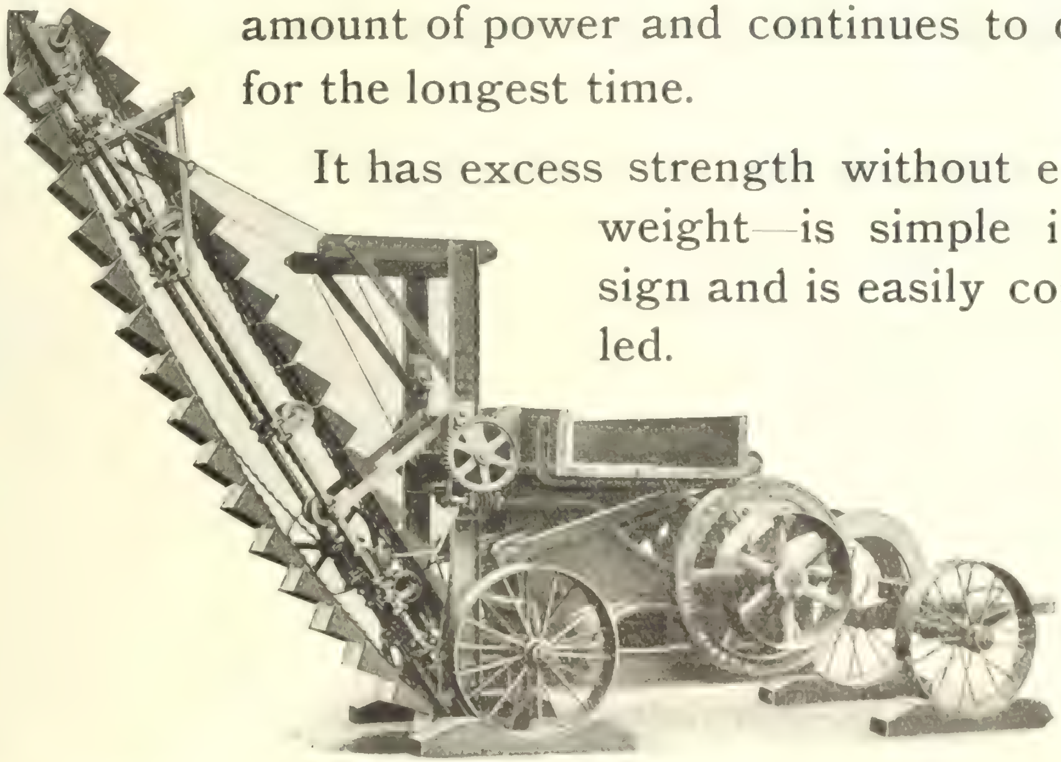
Produces the maximum amount of stone for the minimum amount of power and continues to do so for the longest time.

It has excess strength without excess weight—is simple in design and is easily controlled.



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See our exhibit of road machinery at the Montreal Good Roads Congress, May 18 to 23rd.

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  Wettlaufer Bros.

Cupolas (Foundry)
  Northern Crane works

Culverts
  Pedlar People.

Cylinders for Liquified Gases
  Mannesmann Tube Co.

Derricks and Derrick Fittings.
  American Hoist & Derrick Co.
  Beath & Son, W. D.
  Hepburn, John T.
  Sasgen Derrick Company

Dredges
  Beatty & Sons, M.
  Browning Company.
  Morris Machine Works.

Drills
  Beatty & Sons, M.
  Canadian Allis-Chalmers, Ltd.
  Canadian Buffalo Forge Co.
  Canadian Ingersoll-Rand Co.
  Lecky & Collis
  Star Expansion Bolt Co.

Drill Steel Sharpeners
  Canadian Ingersoll-Rand Co.

Drop Forgings
  Canadian Billings & Spencer, Ltd.

Drying Apparatus
  Sturtevant Co. of Can. Ltd. B. F.

Dump Cars, Wheels, etc.
  Bechtels Limited
  Manitoba Bridge & Iron Works.
  Schell Foundry & Machine Co.
  Western Wheeled Scraper Co.
  Weller Mfg. Co.
  Sheldons Limited.

Dump Carts and Wagons
  Deere Plow Co., John.
  Troy Wagon Works

Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electrical Machinery and Supplies
  Ferranti Electrical Co.
  Sturtevant Co. of Can. Ltd. B. F.

Electric Fans
  Sturtevant Co. of Can. Ltd. B. F.

Elevators
  Roelofson Elevator Works.

Enamelled Brick
  American Enamelled Brick & Tile Company

Engines
  Boving Company of Canada
  Canadian Buffalo Forge Co.
  Canadian Sirocco Co.
  Inglis Co., John
  Jenckes Machine Co.
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks.
  Mussens Limited
  Waterous Engine Works Co.
  Wettlaufer Bros.

Engineers (Civil and Mechanical)
  Bowman & Connor
  Campbell, R.
  Chipman & Power
  Dominion Engineering & Inspection Company.
  Farmer, John T.
  Galt Engineering Co., John
  Lea & Ferguson
  Mitchell, C. H.
  Thorold Co., F. W.
  Tyrrell, H. G.

Excavators
  Austin Drainage Excavator Company, F. C.
  Brown Hoisting Machinery Co.
  Municipal Engineering & Contracting Company.
  Parsons Company, G. W.

Expansion Bolts
  Star Expansion Bolt Co.

Expanded Metal
  Mannesmann Tube Co.
  Pedlar People Limited.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Fans
  Canadian Sirocco Co.
  Sheldons Limited.
  Sturtevant Co. of Can. Ltd. B. F.

Fuel Economizers
  Sturtevant Co. of Can. Ltd. B. F.

(Continued on page 121)

Built for C.P.R. Montreal

Canadian Plant

Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

OFFICES:
Bridgeburg, Ont., 130 Janet St.
Chicago, Ill., 1360 W. 105th St.

SHOPS:
Bridgeburg, Ont.
Chicago, Ill.
Greenville, Pa.

KOEHRING CONCRETE MIXERS

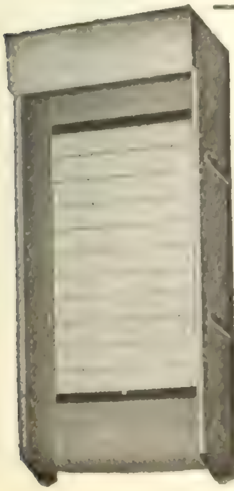
Mixer on Trucks with Steam Power, Side Loader and Water Measuring Tank, front view showing Side Loader in raised position. Note the vertical position of the Bucket, enabling it to discharge completely into the drum without *pounding*.

A very rigid and substantially made steel frame is evidenced in all Koehring Mixer construction and the trucks are of the three point suspension type with pressed steel axles, and steel wheels of safe carrying load capacity. A strong feature that appeals to the contractor is the simple and strong side loader, which elevates to an almost perpendicular position, thereby discharging freely and rapidly into the drum and the ease with which it is operated and kept under positive control. The friction clutch is of special toggle link design, which requires little adjusting and is powerful and positive.

CANADIAN ALLIS-CHALMERS, LIMITED

[illegible]

HEAD OFFICES: TORONTO. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver,, Victoria, Prince Rupert.



NOW is the time to renew your

SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
Hamilton

AN OPPORTUNITY

Local Agents Wanted in

Quebec, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

Water Filters
1,000 to 1,000,000 Gallons a Day

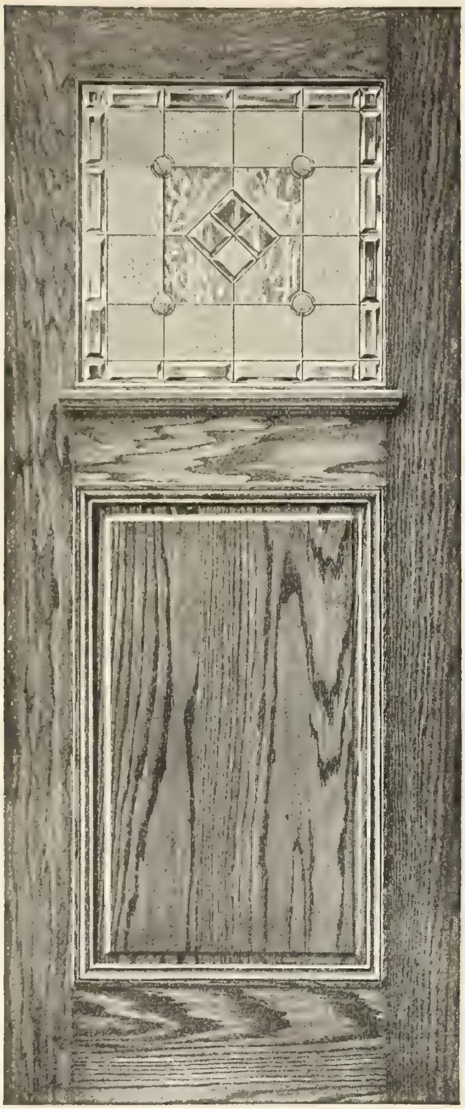
Refrigerating Machinery
1/4 to 60 Ton Daily Capacity

Water Purifiers
4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED
302 McGILL BLDG., MONTREAL, P. Q.

Doors
Base
Balusters
Columns



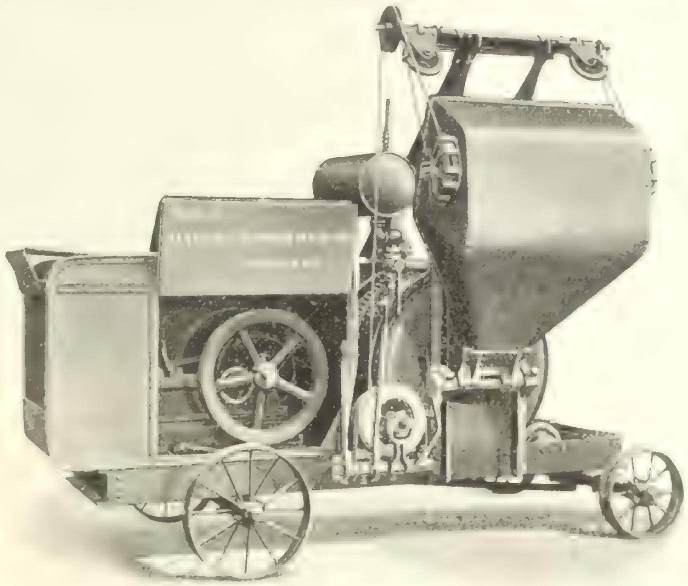
Sash
Trim
Turnings
Newels

IF you want high-class doors of good appearance and made of selected woods, we suggest Batts Limited as the place to get them. The workmanship in our doors is thorough and all woods are properly seasoned giving the doors long life. In our columns the special "V" lock joint makes it impossible for them to crack or open. Specify "Batts" doors, columns and trim.

Batts
Limited
Pacific Ave., Toronto

ANNOUNCEMENT

Most Mixing



Least Fixing

It is with much satisfaction that we announce to the contractors and builders of Canada our recent connection with the Marsh-Capron Mfg. Co., of Chicago. Knowing full well the heavy demands placed upon a concrete mixer in Canada we spared no effort to determine which, in our estimation, was the best mixer built. As a result of this investigation we are proud to offer

THE M-C RAIL TRACK MIXER

Equipped with Fairbanks-Morse Gasoline Engines

There are several hundred of these mixers in successful operation in Canada—there were five used on the big C. P. R. irrigation job at Bassano, Alberta. We carry a complete stock of all sizes and equipment at our several warehouses and are always in a position to make immediate shipments quick.

Write our nearest branch

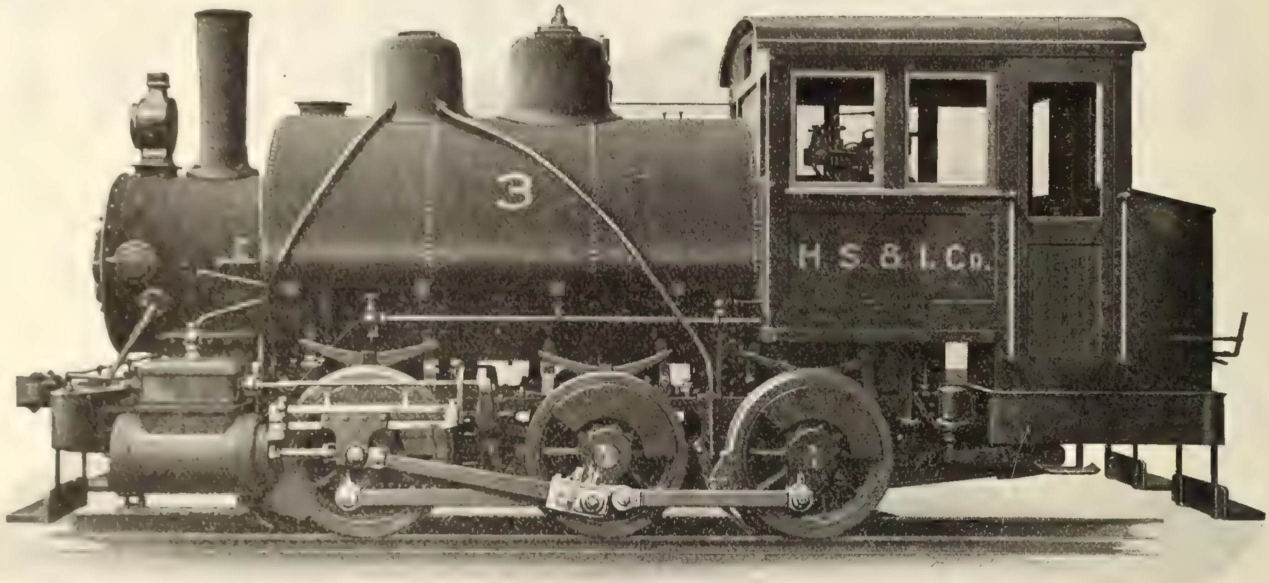
CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

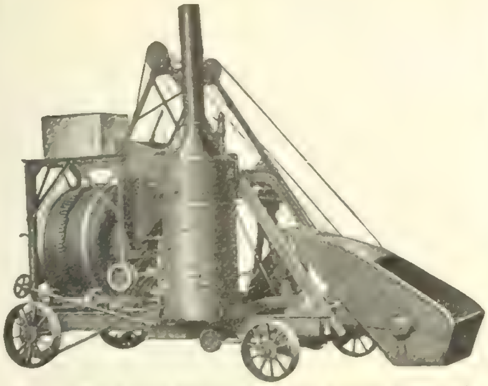
VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

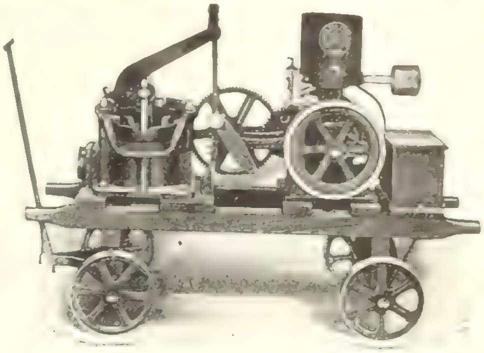
Keep the following Names in Mind when Ordering High Grade Brick.

Beaver Clay Mfg. Co.
Columbus Brick and Terra Cotta Co.
Hydraulic-Press Brick Co.
Hocking Valley Fire Clay Co.
Kushequa Brick Co.
Ohio Mining & Mfg. Co.
Pearl Clay Products Co.
Tiffany Enameled Brick Co.

BLACK BUILDING SUPPLY CO., LTD. - TORONTO



Rear Discharge Paving Machine with Forward Loader.



Diaphram Pump with Power

We are the largest manufacturers of Concrete Machinery in Canada.

We Cannot Afford to Make anything but the Best.

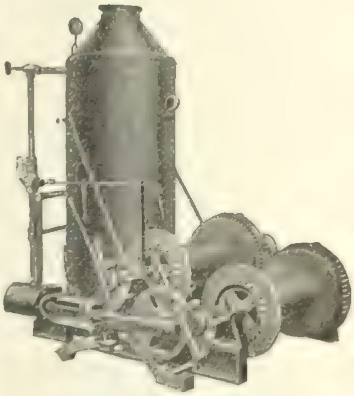
CONCRETE MIXERS, MORTAR MIXERS, CONCRETE BLOCK MACHINES, CEMENT BRICK MACHINES, CEMENT TILE MACHINES, TILE MOULDS, ROCK CRUSHERS, PUMPING OUTFITS, HOISTS & DERRICKS

London Concrete Machinery Co.
Limited

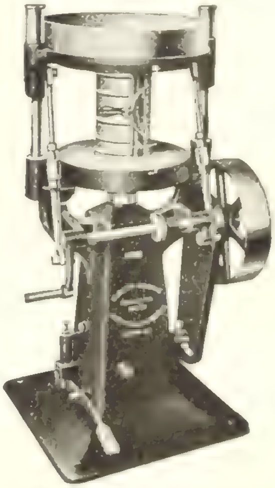
Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—445 Main Street—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—F. D. Emsley, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Fort William, Ont.—Northern Eng. & Supply Co.
Quebec, Que.—A. D. Masson.
Ottawa—The General Supply Co., of Canada.



Standard Hoisting Engine



Dunn Cement Drain Tile Machine

Sherardized Herringbone Lath

Is the *Acme* of *Perfection*

Five exposure tests on galvanized conduit pipe have just been completed at the Northern Chemical Engineering Laboratory, Madison, Wisconsin. In these tests Sherardized pipe proved best in four cases, hot galvanized best in one, and electro-galvanized uniformly "also ran."

The case in which hot galvanized proved best was exposure in an underground tunnel carrying steam pipes. The frame when recovered was fallen down and partly covered with dirt and the test was regarded as inconclusive.

Why don't you test Sherardized Lath?

Clarence W. Noble, ***General Sales Agent***

Winnipeg **117 Home Life Building, TORONTO** **Montreal**

The Metal Shingle & Siding Company, Manufacturers

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Field Instruments
- Gurley, W. & L. E.

Filters
- American Water Softener Co

Fire Brick
- Ontario Lime Co., Ltd.
- [illegible] & Ryan

Fire Escapes
- Manitoba Bridge & Iron Works.
- McGregor & McIntyre

Fireproof Doors and Windows
- [illegible] & Roadhouse
- Hope & Sons, Henry.
- Mussens Limited
- Pedlar People Limited.
- Steel & Radiation Limited

Fuse (Safety Blasting)
- Lecky & Collis

Fixtures (Gas)
- Consumers Gas Co.

Folding Doors
- Springer, O. T.

Forges
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Canadian Sirocco Co.

Forgings
- Canadian Billings & Spencer, Ltd.

Gas Engines
- Armstrong Mfg. Co.
- British Mfrs. Assn. of Canada.

Gasoline Engines
- Armstrong Mfg. Co.
- Original Gas Engine Co.
- Wettlaufer Bros.

Glass
- Consolidated Glass Co.
- Hobbs Mfg. Co.
- Luxfer Prism Co.
- Toronto Plate Glass Imp't'g Co.

Gravel Washing Plants
- Dull Co., Raymond W.

Hammer Drills
- Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
- Boving Company of Canada
- Escher Wyss & Co.
- Mannesmann Tube Company.
- Pittsburgh Valve, Foundry & Construction Company

Hoists
- Northern Crane Works.
- Roelofson Elevator Works

Hoisting Apparatus
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
- Morris Hoist & Crane Co., Herbert.
- Mussens Limited
- Royce Limited
- Sturtevant Co. of Can. Ltd., B. F.

Heating Apparatus
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Sheldons Limited

Hoisting Engines
- Canadian Allis-Chalmers, Ltd
- Canadian Fairbanks-Morse Co.
- Wettlaufer Bros.

Hydrants
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

Ice-making Machinery
- Linde British Refrigeration Co.

Insulating Compounds
- Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
- Batts Limited
- Canada Office & School Fur. Co.
- Rhodes Curry & Co.

Jib Cranes (all kinds)
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Kilns
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.
- Canadian Sirocco Co.
- Berg Machinery Mfg. Co.

Lime
- Dominion Lime Company.
- Jamieson Lime Co.
- Ontario Lime Co., Ltd.

Lighting and Pumping Installations
- Lister & Co., Ltd., R. A.

Locomotives
- Boving Company of Canada
- Canadian Allis-Chalmers, Ltd.
- Canadian Locomotive Company
- Montreal Locomotive Works
- F. H. Hopkins Co.
- Mussens Limited

Mechanical Draft Apparatus
- Sturtevant Co. of Can. Ltd. B. F.

Metal (Anti-Corrosive)
- Stark Rolling Mill Co.

Metal Lath
- Greening Wire Co., B.
- Metallic Roofing Co.
- Noble, C. W.
- Pedlar People Limited.
- Steel & Radiation Ltd

Meters, Electrical
- Ferranti Electrical Mfg. Co.
- Canadian Allis-Chalmers, Ltd.

Meters, Water
- Hopkins & Co., F. H.
- McDougall Caledonian Iron Wks
- Neptune Meter Co.

Overhead Runways
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Paints and Varnishes
- Dominion Paint Works
- Hopkins & Co., F. H.

Paints (Bridge and Structural Iron and Pipe Coating)
- Dominion Paint Works

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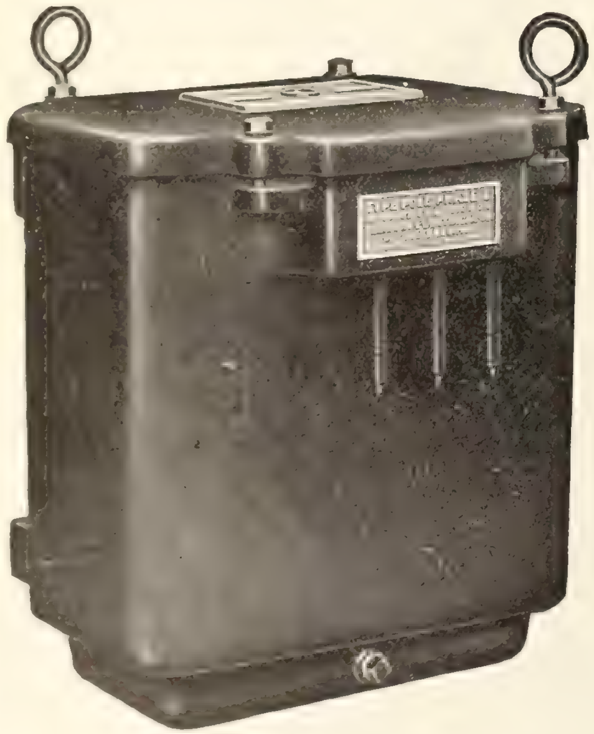


Ferranti Transformers

A transformer to be efficient must be economical to install, economical to operate and must have a minimum of core and copper loss. These good points will be found in Ferranti Three Phase Transformers.

Whether on the line or in the station Ferranti Transformers will give all-day high efficiency.

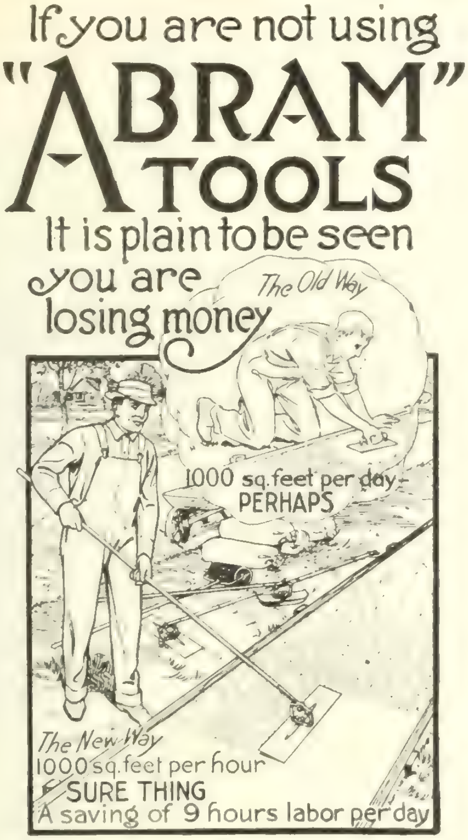
The design is very substantial and all parts are easily accessible.

Let us quote you prices

The Ferranti Electrical Co. of Canada, Ltd.

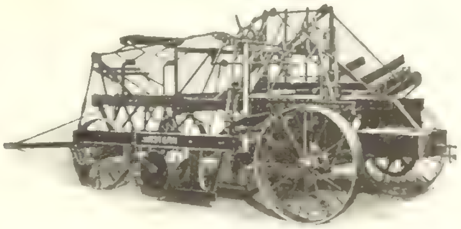
90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG



Abram Cement Tool Co.,
Windsor, Ontario

Load Your Wagons with a **WESTERN**



The contractor who wants the best Dump Wagon on the market purchases a Western. In the same way the Western Elevating Grader is his choice when investing in a wagon loader.

Western Elevating Grader

The Western will load wagons of 1½ yards capacity at the rate of three wagons per minute and one hundred per hour.

WRITE US FOR CATALOGUE

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

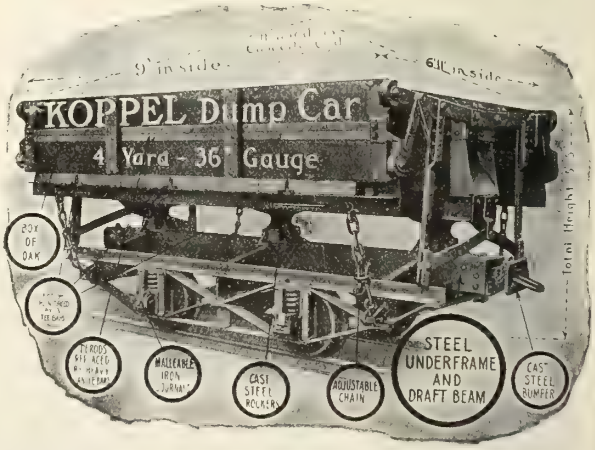
CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Partition Hangers
  Springer, O. T.
Paving and Paving Materials
  Asphalt & Supply Co
  Aztec Oil Asphalt Co
  Baker Co., R. D.
  Barber Asphalt Paving Co.
  Dominion Creosoting Company
  Ontario Asphalt Block Co.
  Paterson Mfg. Co., B.
Perforated Metals
  Canada Wire & Iron Goods Co.
  Greening Wire Co., B.
Pipe Machinery
  Sutcliffe, Speakman & Co.
Pipe (Concrete, Iron and Wood)
  American Spiral Pipe Works
  Canadian Allis-Chalmers, Ltd.
  Canadian Pipe Co.
  Dominion Concrete Co.
  Gartshore-Thomson Pipe Co.
  Mannesmann Tube Company
  National Concrete Mfg. Co.
  National Iron Works
  National Pipe & Foundry Co.
  Pacific Coast Pipe Co.
  Piggott & Co., Thos.
  United States Cast Iron Pipe Co
  Vancouver Wood Pipe & Tank Company.
  Walsh Plate & Structural Works.
Pile Driving Machinery
  American Hoist & Derrick Co.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Ingersoll-Rand Co.
  Lecky & Collis
Pipe Fittings and Flanges
  Pittsburgh Valve, Foundry & Construction Company
Plumbing Supplies
  Mueller Mfg. Co., H.
Planing Mill Exhausters
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.
Plaster
  Alabastine Hardmortar Co.
  Albert Mfg. Company
  Britnell & Company
  Ontario Lime Co., Ltd.
Plumbing
  Dietrich Limited
Pneumatic Machinery
  Canadian Ingersoll-Rand Co.
Portable Saws
  Canadian Fairbanks-Morse Co.
Portable Track
  Bechtels Limited
Pulleys
  Sutcliffe, Speakman & Co.
Pumps and Pumping Machinery
  Beatty & Sons, M.
  Boving Company of Canada
  British Mfrs. Assn. of Canada.
  Canadian Allis-Chalmers, Ltd.
  Canadian Buffalo Forge Co.
  Canadian Fairbanks-Morse Co.
  Canadian Ingersoll-Rand Co.
  Canadian Sirocco Co.
  Cook, A. D.
  Gray Mfg. & Machine Co.
  Hamilton Mfg. Co., Wm.
  Honig & Mock.
  Inglis & Company, John
  McDougall Caledonian Iron Wks.
  Morris Machine Works.
  Smart-Turner Machine Co.
  Waterous Engine Works Co.
  Mussens Limited
  Ontario Wind Eng. & Pump Co.
  Wettlaufer Bros.
Plug Drillers
  Canadian Ingersoll-Rand Co.
Power Engines
  Inglis Company, John
  Jenckes Machine Company
  Canadian Allis-Chalmers, Ltd.
  Waterous Engine Works
Quarry Machinery
  Canadian Allis-Chalmers, Ltd.
  Canadian Ingersoll-Rand Co.
  Improved Equipment Co.
  Lecky & Collis
  George Anderson & Co.
  Goodwin, Barsby & Company.
  Rock & Power Machinery, Ltd.
Radial Brick Chimneys
  H. R. Heinicke Inc
Railway Supplies
  Gartshore, John J.
  Hopkins & Co., F. H.
  Lecky & Collis
  Mussens Limited
Refrigeration Machinery
  Equipment & Supplies, Limited.
  Linde British Refrigeration Co.
Reinforcements, Concrete & Steel
  Brown Hoisting Machinery Co.
  Burlington Steel Company
  Canada Wire & Iron Goods Co.
  Dominion Iron & Steel Co.
  Greening Wire Co., B.
  Pedlar People Limited.
  Steel & Radiation Ltd.
  Trussed Concrete Steel Co.
  Turner, C. A. P.
Road Asphalt
  Barber Asphalt Paving Co.
  Asphalt & Supply Co.
Road Machinery
  Dore & Fils
  General Car & Mach. Works
  Lecky & Collis
  Morrison & Co., T. A.
  Mussens Limited
  Waterous Engine Works Co.
  Western Wheeled Scraper Co.
Revolving Stone Screens
  Goodwin, Barsby & Company.
  Greening Wire Co., B.
Roof Glazing
  Hope & Sons, Henry.
Roofing Material
  Asbestos Mfg. Company
  Barber Asphalt Paving Co.
  Bird & Son
  Can. H. W. Johns-Manville Co.
  Can. Supply & Contracting Co.
  Metallic Roofing Company
  Noble, Clarence W.
  Paterson Mfg. Co.
  Pedlar People Limited.
Rubber Belting
  Canadian Fairbanks-Morse Co.
Safes and Vaults
  Taylor, J. & J.
Sand and Gravel
  Ontario Lime Co., Ltd.
  Sand and Supplies Limited
  York Sand and Gravel Co.
Screens
  Canada Wire & Iron Goods Co.
  Goodwin, Barsby & Company.
  Greening Wire Mfg. Co., B.
  Weller Mfg. Co.
Sewerage Ejectors
  British Mfrs. Assn. of Canada.
Sewer Pipe
  Britnell & Company
  Canada Iron Corporation
  Dominion Sewer Pipe Co.
  Gartshore Thomson Pipe Co.
  National Iron Works
  Nova Scotia Clay Works Ltd.
  Ontario Lime Co., Ltd.
  Ontario Sewer Pipe Co.
  Smyth & Ryan
  Standard Clay Products Ltd.
Sewer Trenching
  Lecky & Collis
Sound Deadening
  Cabot, Inc., Samuel
Stains, Shingle, Cement & Brick
  Cabot, Inc., Samuel
Stair Builders
  McGregor & McIntyre

(Continued on page 16)

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Capacity 4000 Tons Daily

Crushed Stone

For all purposes
Any size
Any quantity
We ship promptly
Let us quote you prices on your requirements.

Canada Crushed Stone Corporation, Limited
Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, **each** gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch **in the air**—this is the "3 in 1" MIXER of which you've heard so much.

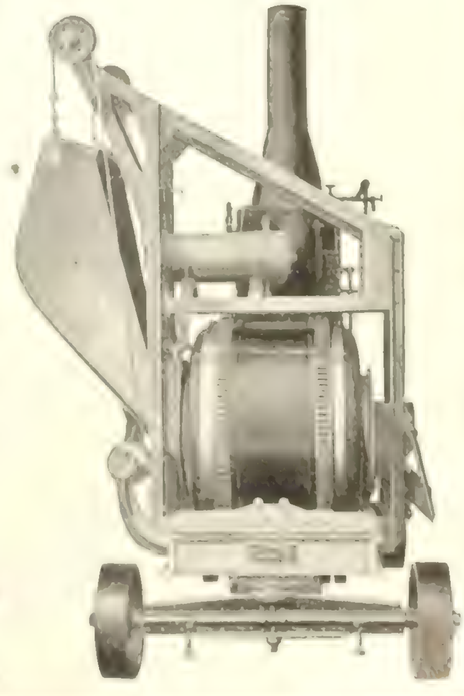
All of these construction details are unimportant if they do not combine to give a mixer that **does more work.**

So, to PROVE the working capacity of a KOEHRING we will place one in competition with **any** other mixer—to do **more** work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent CANADIAN-ALLIS CHALMERS CO., LIMITED
Toronto Winnipeg Calgary Vancouver Montreal Ottawa



CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Shovels (Steam)
  Browning Co.
  Beatty & Sons, M.
  Canadian Allis-Chalmers, Ltd
  Montreal Locomotive Works
  Mussens Limited
  Rock & Power Machinery, Ltd
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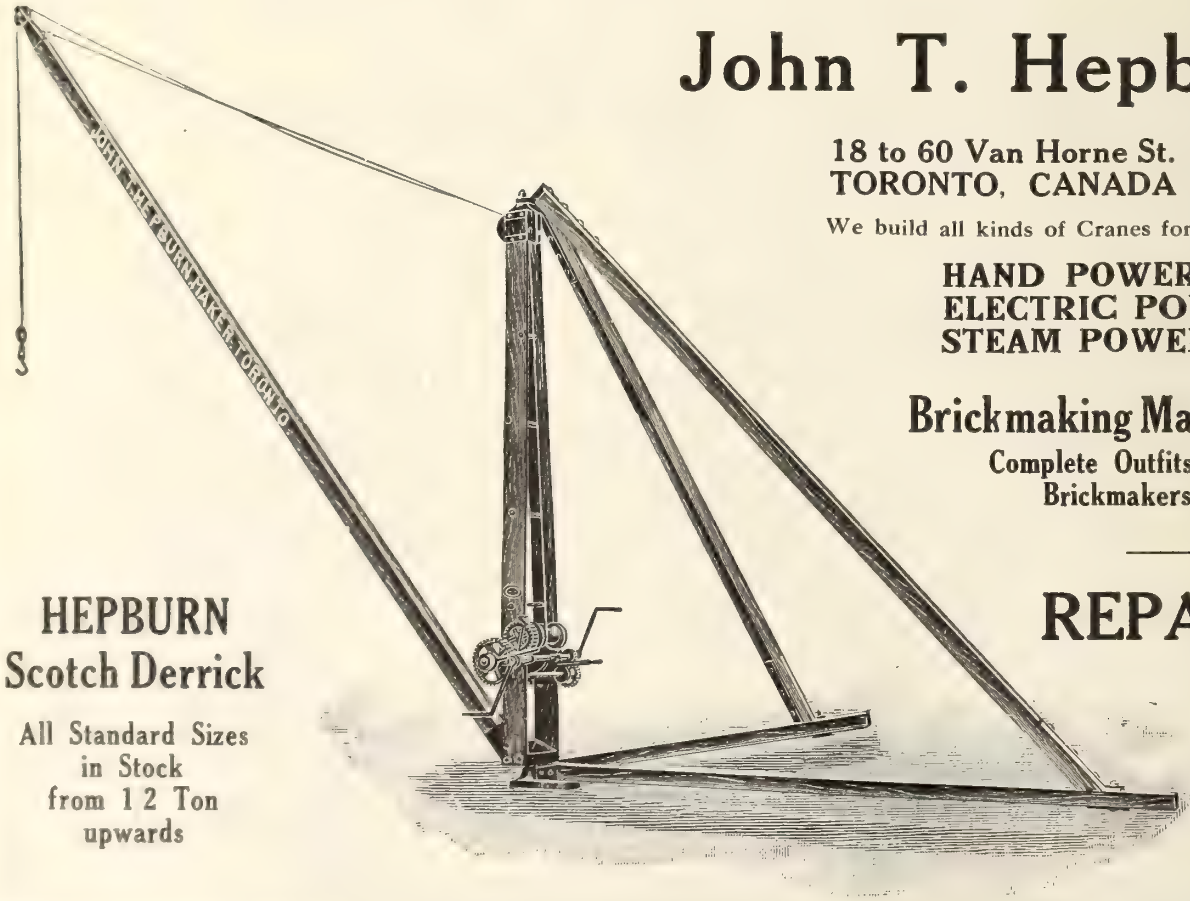
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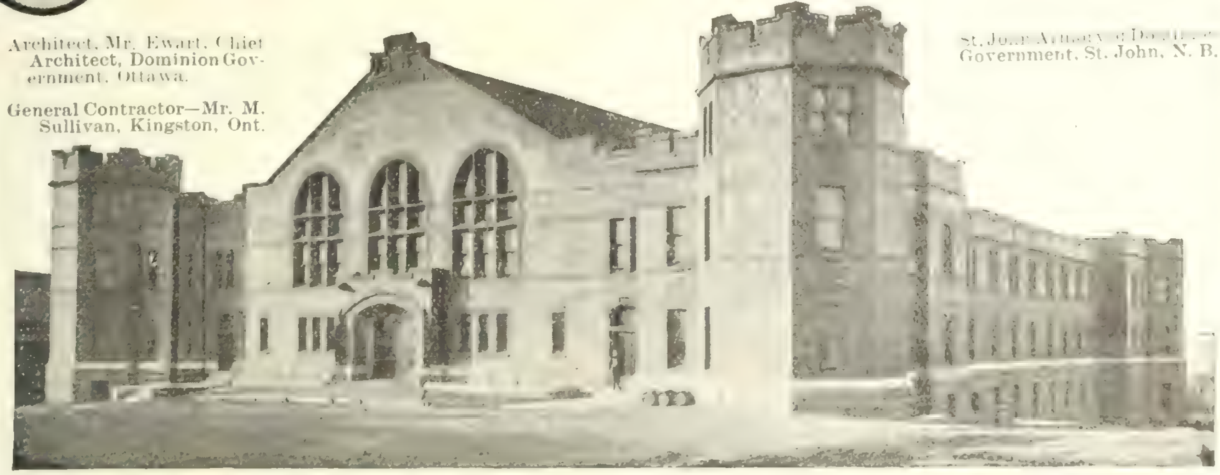

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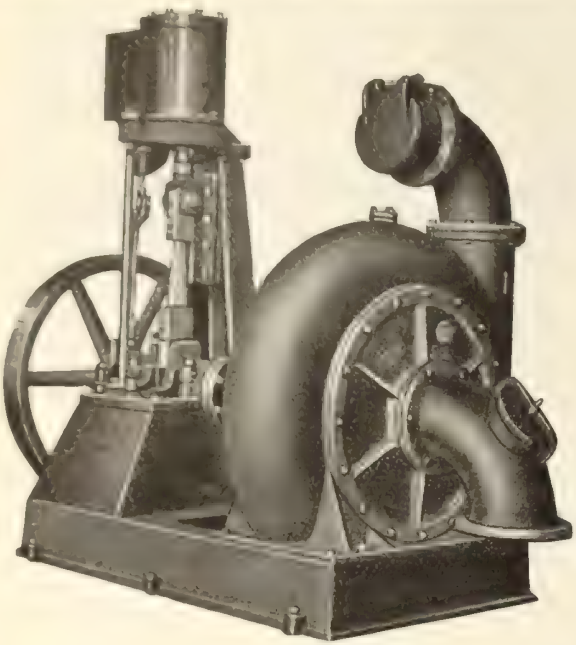

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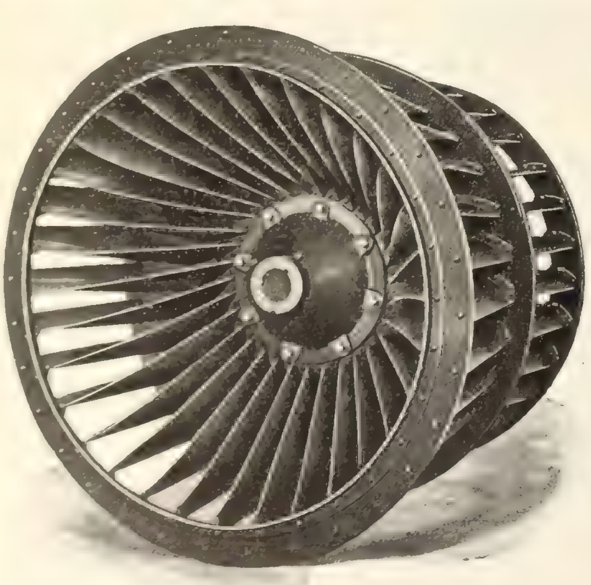

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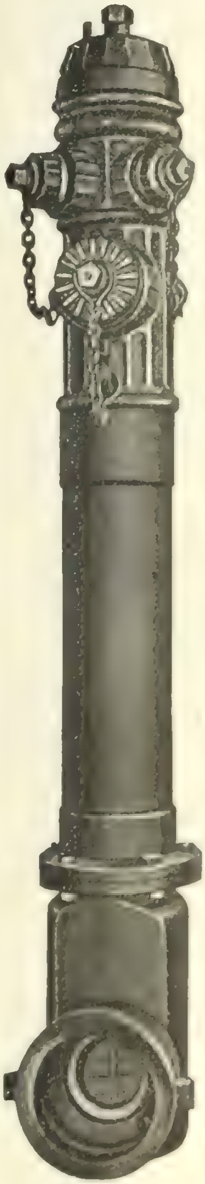

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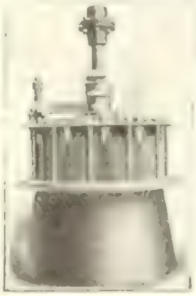

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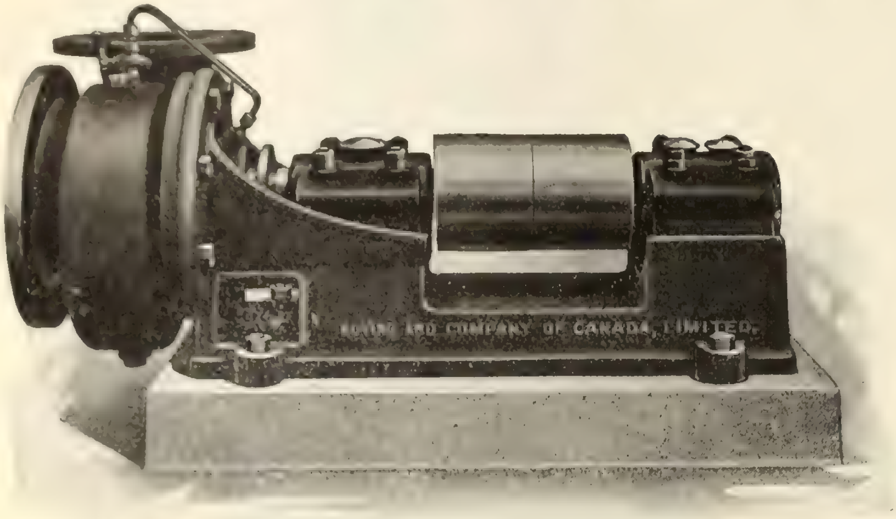

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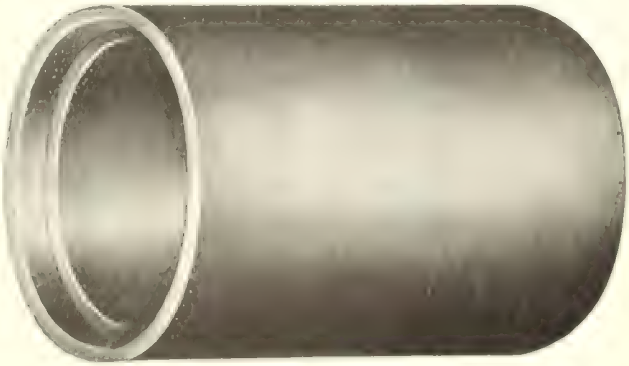

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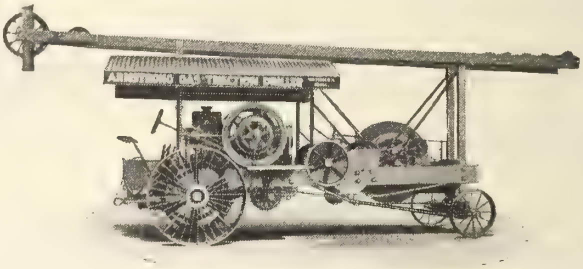
There are "BREAKERS AHEAD" for the Quarry Operator Who Does Not

STOP! and consider—that the most economical method of drilling blast holes is with an Armstrong Special Blast Hole Drill—that the same efficiency should be demanded from the drilling machines as from any of the quarry equipment—that the method of drilling employed frequently represents the division between profit and loss—that in adopting this system of drilling, the labor problem is reduced to a **minimum** and that the **"Armstrong" is the only special blast hole drill designed for rock drilling exclusively.**

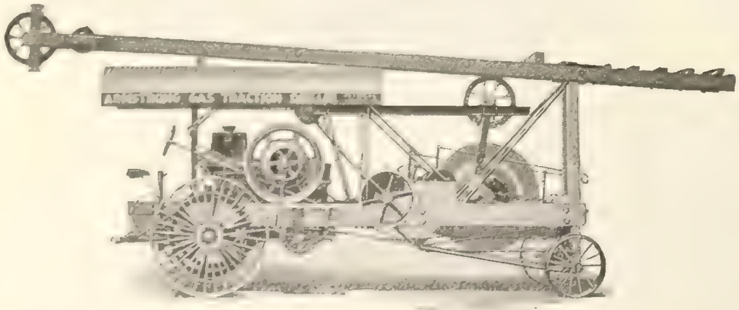
Armstrong Water Well Drill



LOOK! at these two machines illustrated on this page. One is a Well Drill, the other a Special Blast Hole Drill. Little difference in the general design with the exception of the Spudding Beam; but note this difference carefully. That one feature determines the results you can expect from your tools in a drilling motion—is the one point that increases your efficiency from 50% to 100%, and is the reason why the **Armstrong Special Blast Hole Drill** will drill more blast holes, at less cost, and with less wear and tear than any other machine made.

LISTEN! to reasons:—We illustrate our Water Well and Blast Hole Drills so **you** can see the difference—so that **you** will know that the drill we call our Special Blast Hole Drill is not a Water Well Drill, and so that you may "ask to be shown" by any manufacturer of cable drills the difference in the design of their blast hole and water well drilling equipment.

Armstrong Special Blast Hole Drill



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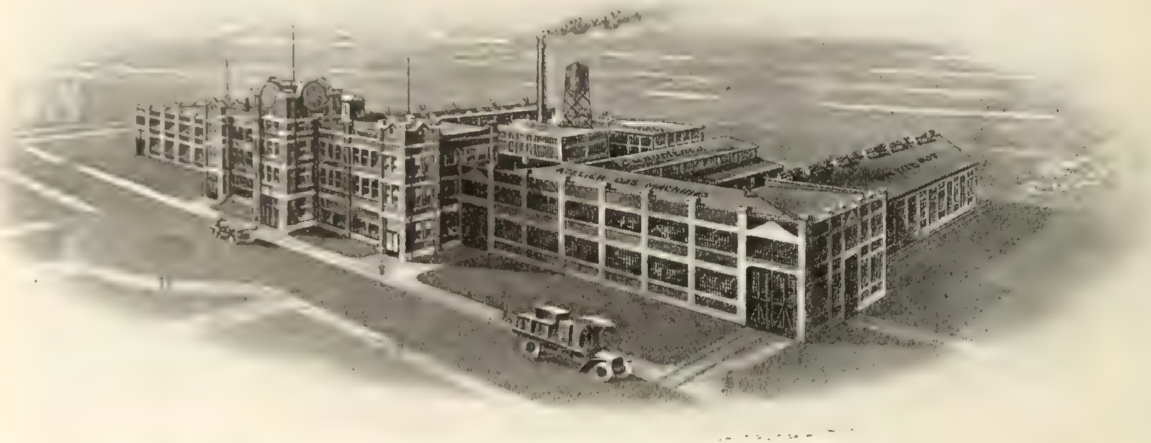
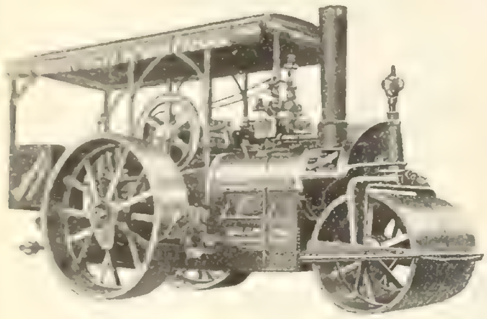
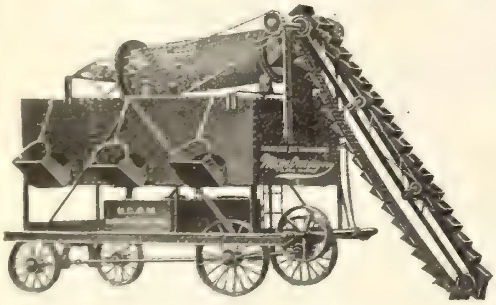


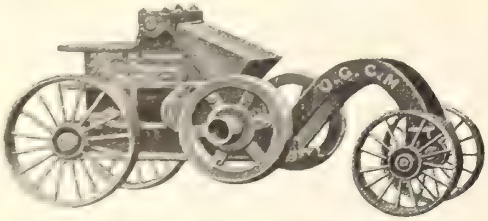
Head Office and Works



"Montmagny" Steam Road Roller.



"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny" Machinery

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A great feature "Power Steering"

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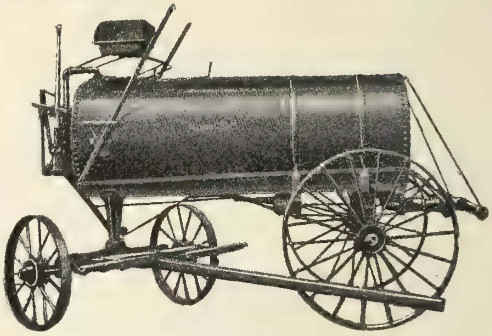

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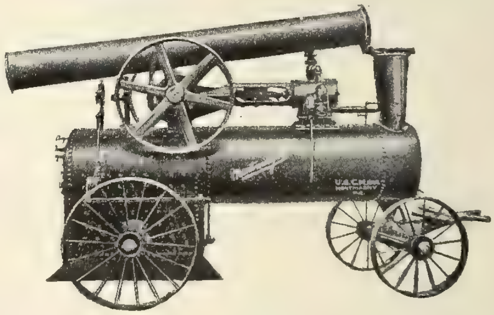
The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.



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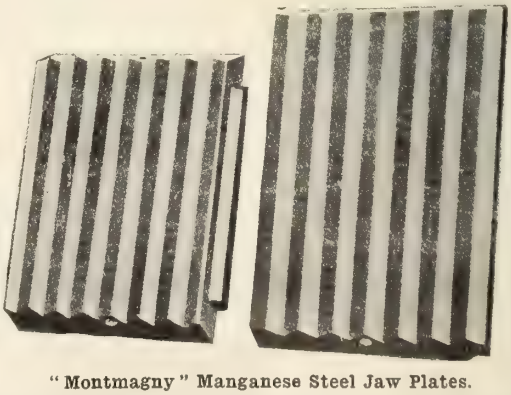

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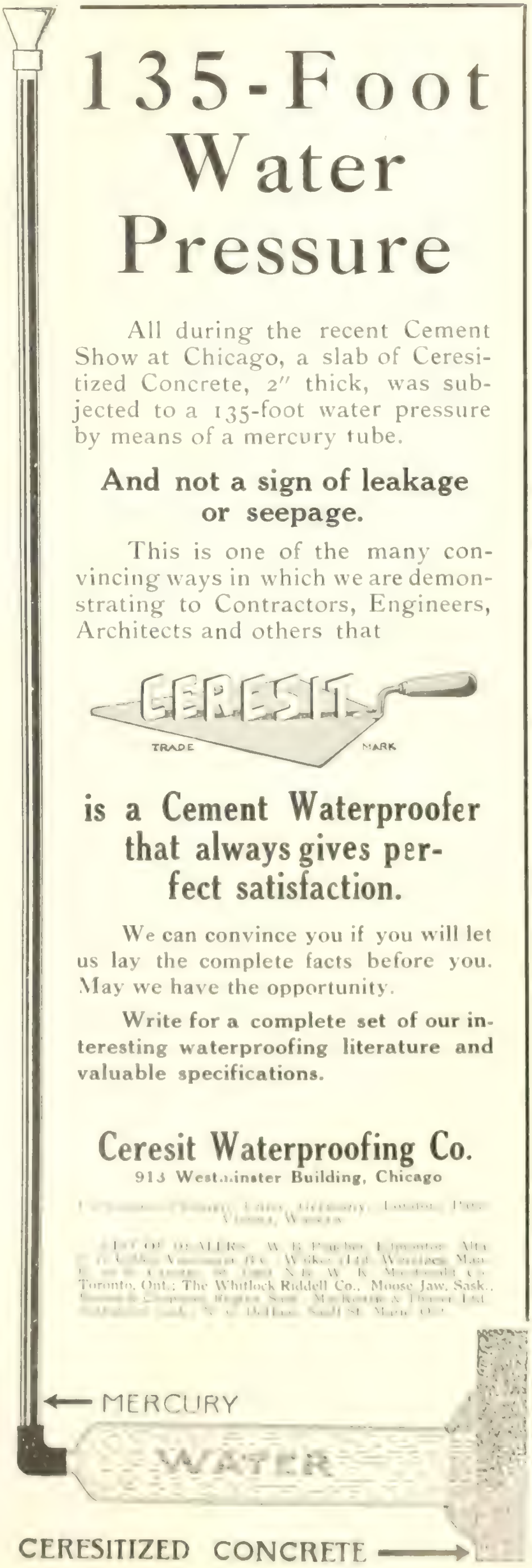

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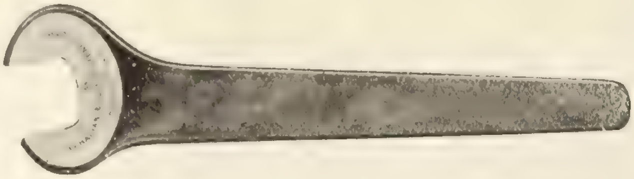

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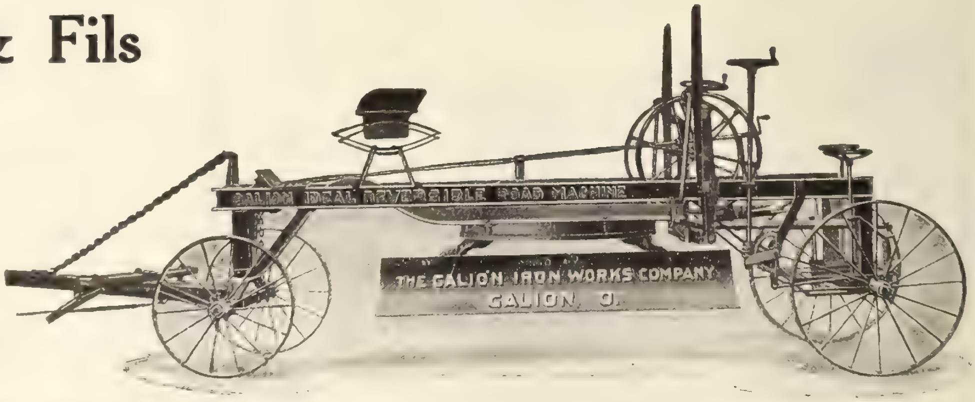
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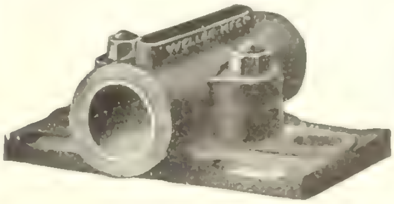

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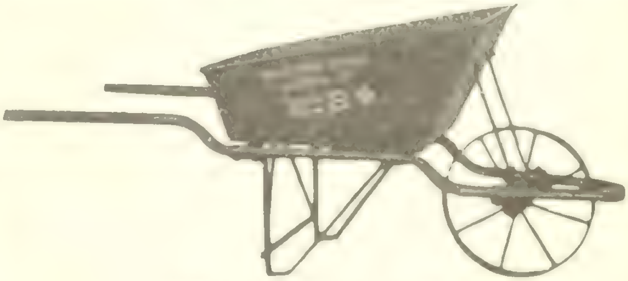

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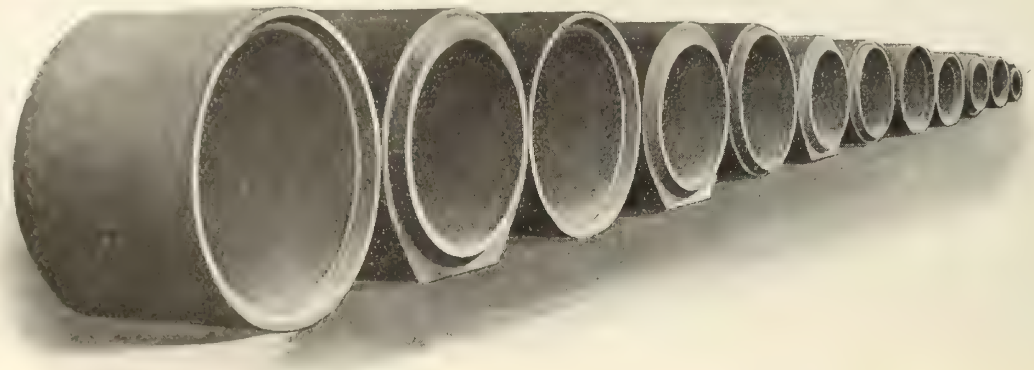

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Yours truly,

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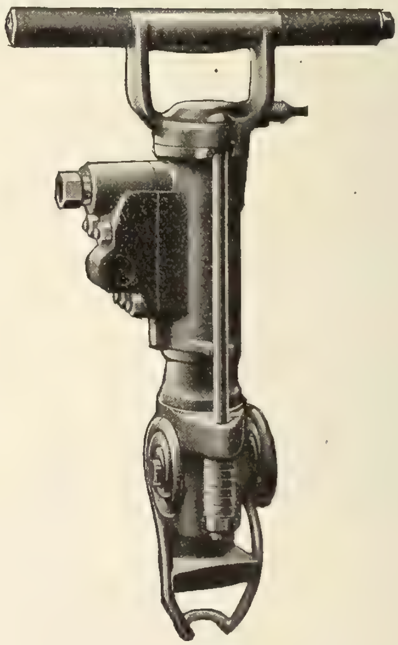

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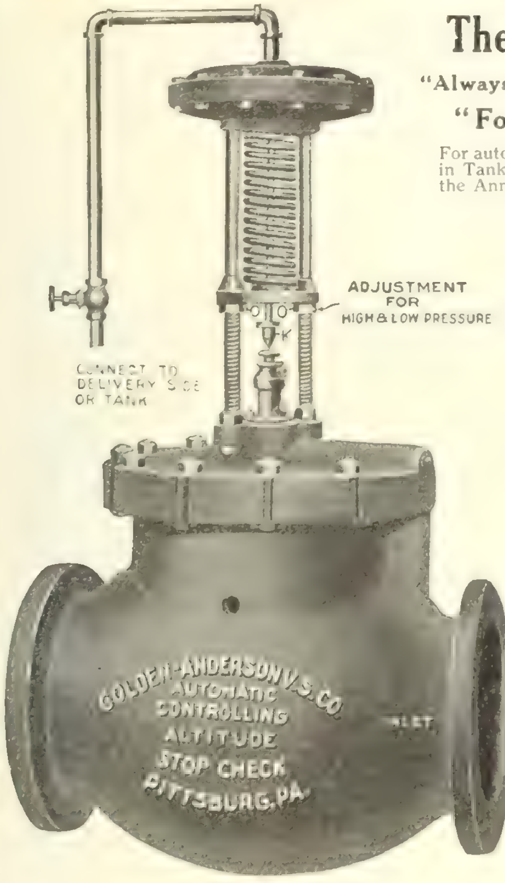

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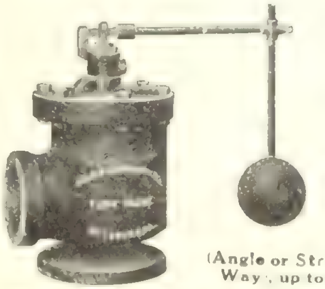

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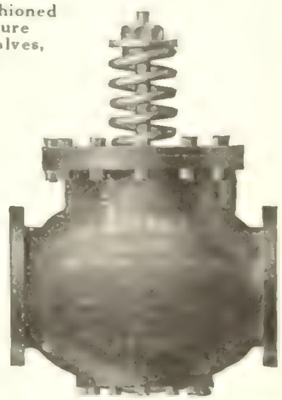

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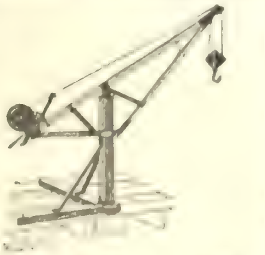

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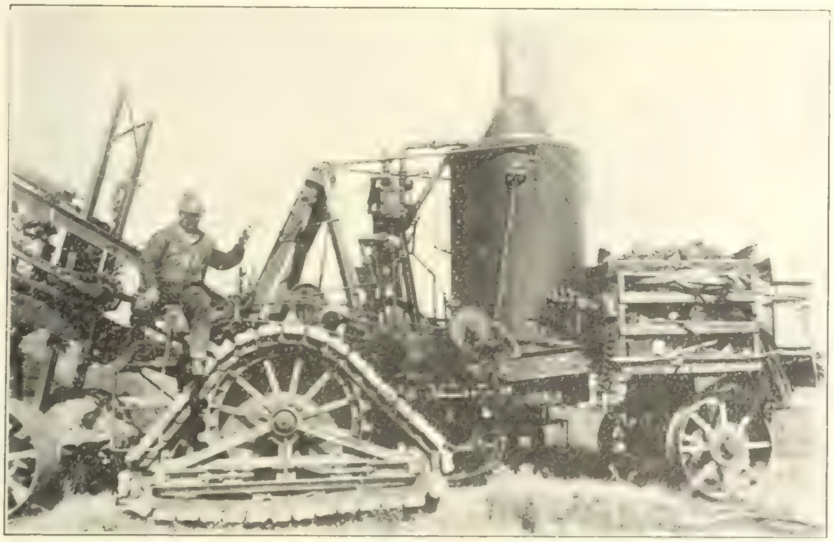

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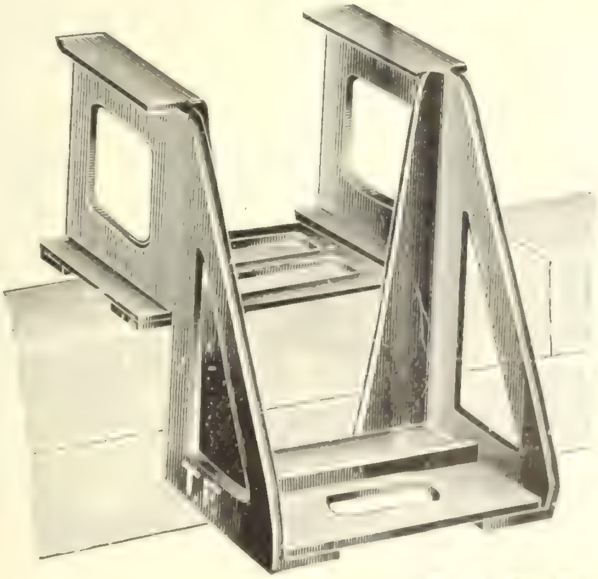

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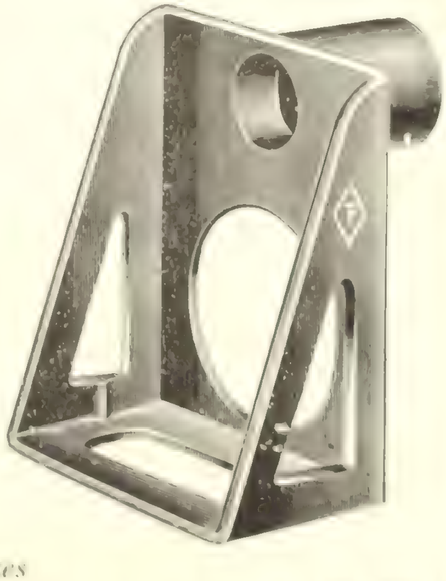

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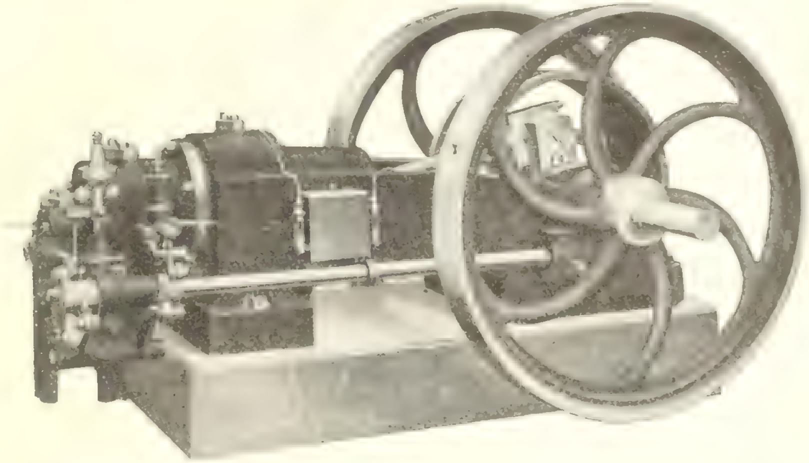

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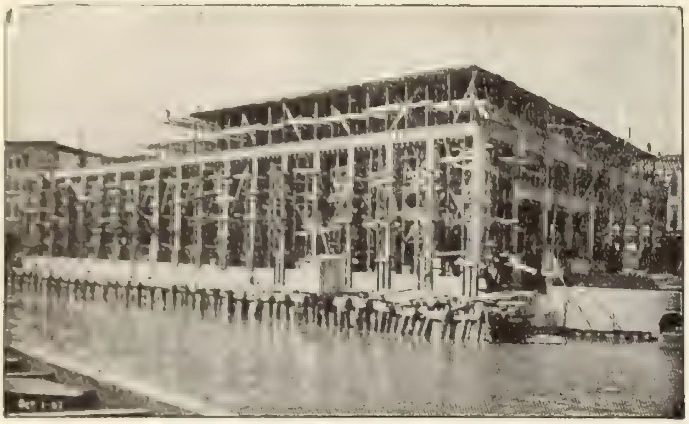

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THOMAS S. YOUNG, General Manager.
HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
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LONDON, ENG. - - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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The Curtain Raised on Toronto's Fire Tragedy

IN our issue of March 25 we commented briefly upon the fire hazard and its responsibilities in connection with the fire at the Woodbine Hotel, Toronto, which resulted in the death of five persons. At the time we refrained from criticising any of the interests concerned on the ground that an investigation was being held. We condemned the public disposition to pass hasty judgment in such matters and censured the daily press for their gratuitous reflections upon those who were in any way related to the work of erecting the building. This we felt constrained to do in the interests of common justice. Now in these same interests we are constrained to make some comment upon the findings of Judge Denton, whose report upon the City Architect's Department of Toronto was submitted to the Mayor last week.

While the disaster at the Woodbine Hotel is a side issue of the report, the tragic occurrence makes the findings additionally interesting. It is as if the curtain were raised on the closing scene of a tragedy, revealing the actors in their several parts. Here it would appear to be an all-star cast with parts of equal responsibility played by the city's officials, controllers and other members of the local administration. A lamentable feature in connection with the spectacle is that apparently there is not one redeeming character among the personnel—not one whose part is to uphold the right.

It is an old, old plot, with the public as the victim, but the story is new in respect to its absolutely sordid character. It is a revelation not of incompetency alone, but of discrimination and graft,—immorality in its worst form. It is a disclosure of the same low standard which has earned for the United States the unsavory notoriety of having had the dirtiest administration in the world. The comment is strong, but in reality it is wholly inadequate to the occasion. The limited vocabulary of the English language is kind to those who juggle with public property and human lives in one hand and personal gain in the other—and this is what is revealed by Judge Denton's report.

It is shown that discrimination has been rife in the City Architect's Department and that the Woodbine Hotel construction was only one instance of the latitude allowed by the officials. The hotel addition did not conform to the requirements of the bylaw in any respect. While the bylaw provided that buildings exceeding 35 feet in height should be fireproof, an addition 42 feet high was built of ordinary joist construction, approved by the Board of Control and a permit issued when the work was almost completed. In the first place permission had been given to change stores into a hotel. Later, a factory building in the rear was acquired for an addition to the hotel, for which, we are told a "tentative" permit—whatever that may be—was secured. That there were inner bathrooms in the addition is a detail, and it is of comparatively minor importance that one fire escape was provided in the rear, access to it being possible only through a bedroom.

If one accept the findings of the report it is impossible to urge reform. It is shown that controllers, aldermen and public servants have abused the public trust, that they have shown discrimination, accepted bribes and used their offices for the advancement of purely personal interests. Employees of the Architect's Department have accepted fees for making plans which, afterwards, for a further consideration, were approved either by themselves or by their coconspirators (it were a misnomer to say colleagues—a colleague as generally accepted, being an associate with another in an honorable undertaking).

We say that it is impossible to urge reform, because in view of Judge Denton's findings we regard the five lives lost in the Woodbine Hotel as having been a direct sacrifice to the cupidity of the city's administration and its satellites. To reform is to fashion anew, to amend, to reclaim. What is needed is not a house-cleaning but a new structure.

We are thoroughly in accord with Judge Denton's recommendation that the present City Architect's Department should be abolished and be replaced by a separate branch of civic government—known, perhaps, as The Department of Buildings. We might go a step farther and urge the removal from office of certain members of the Board of Control and Property Committee the majority of whom are ignorant men totally unqualified to discharge their duties. This we should do if we were pressing for justice on behalf of the relatives of those lost in the Woodbine fire. But we are not. Our viewpoint is an altogether wider one. We are concerned with the efficient administration of all matters constructional in which the public safety is involved. As a personal matter we hold the opinion that to retain in office the officials who figure in Judge Denton's findings would be an unmitigated outrage of all the canons of public decency. But our observations must not be mainly personal, but in the main impersonal.

For years the city of Toronto, the greatest building centre in the wide Dominion, has been carrying on its constructional activities under the most deplorable conditions. There is a modicum of consolation in the reflection that perhaps, after all, the Woodbine Hotel disaster may hasten the work of re-organization. For years Toronto builders have been carrying on their operations according to a code the terms of which, until quite recently, were opposed to all good practice. The shortcomings of the by-law as it now stands were shown in the able report recently submitted to Judge Denton by Mr. C. R. Young, Assistant Professor of Structural Engineering in Toronto University.

It has remained for Judge Denton to give the city the basis for a complete re-organization. It remains for the city to act on the spirit of the recommendations. No other course can be pursued by any self-respecting community.

It is not difficult to see that some of Judge Denton's recommendations have been inspired by experts. Some of the suggestions made are particularly commendable—such, for instance, as having plans examined by men specially qualified in each case to deal with the various types of construction. The importance of adequate inspection is very properly emphasized and a proposal to increase the scale of fees may be endorsed on the ground of giving much and expecting much. A recommendation which we endorse most heartily is that the building bylaw should be carefully considered by the new head of the department with a view to its revision, in order that while preserving the necessary margin of safety any unnecessary cost of building may be avoided.

We repeat that it is inconceivable that the city of Toronto, one of the most important constructional centres in America, should continue to nurture in office men who are content to see her progress restricted by regulations which bear throughout the impress of ignorance—men who subordinate public interest to personal enrichment; men who are content to remain inactive in face of the certain knowledge that the Toronto building regulations afford the ridiculous anomaly of being so excessive in their requirements on the one hand that they entail an annual loss estimated by Professor Young at nearly a million dollars and on the other hand so lax and easily over-ridden by controllers, property commissioners and their friends that forms of construction are permitted which invite disaster and court death.

What Concrete Will Not Stand

PRACTICALLY every failure and near failure in concrete has been due to confidence on the part of somebody that concrete can surmount all manner of bad usage, comments Engineering News. The fact is that there are plenty of good standards in concrete design and in concrete construction, but that they are not observed by many of those engaged in concrete building.

This neglect has a three-fold cause: ignorance, undue economy and over-confidence—and the first two could not exist were it not for the last. It is a pretty poor concrete man who does not know that frozen concrete will not set—but there are plenty who will take a chance with ten-day concrete at 40 degrees F. if they need the forms. Why? Primarily because they want to save the money that an additional set of forms would cost. But if there were not confidence that the concrete will stand up, the pocket book would not govern judgment.

Practically every designer of concrete buildings will admit that 850 pounds per square inch is too high a stress in the concrete beams over the room where his own family sits down to dinner, but he is not so worried about that stress when it is in someone's garage. He feels confident that it will not fall down, in spite of tests which show it to have a low safety factor.

Throughout the whole field this pernicious combination of ignorance and complacency extends; instances might be multiplied almost without end. It is our duty to urge upon the workers in the industry a proper appreciation of the dangers of this over-confidence. Skinning of work is a species of ignorance, for nothing is quite so evident as the fact that good work in concrete construction pays. But the man who thinks he knows more than the so-called authorities is the hardest to reach because he is clad in the nearly impenetrable armor of conceit.

Every concrete failure means a slight betterment in methods, for a certain number of hitherto unconvinced practical or commercial men are shown by that most potent object lesson, a heap of ruins, just what concrete will not stand.

Mr. J. L. Weller, chief engineer of the Welland Ship Canal, was accorded a hearty vote of thanks by a St. Catharines audience recently for his instructive lecture on the progress and scope of the work on the big waterway. Making comparisons with the Panama Canal he pointed out that the Panama locks were 1,000 ft. long, 110 ft. wide and 80 ft. high, with a lift of not more than 30 ft. The lock of the Welland Ship Canal would be 800 ft. long, 80 ft. wide, 82 ft. high and would have a lift of 46½ ft. at each lock. The lock gate weighed 1,100 tons, against 700 tons for the largest leaf of the Panama waterway.

Engineering Topics in the Old Land

A Discussion of the Suggestions Advanced in Regard to the Responsibilities of the Engineer under Lay Administration—Centralization and Decentralization with their Attendant Evils as Exemplified by English Methods—Professional Society Work and Its True Functions

By the London (Eng.) Correspondent of the Contract Record

THE recent correspondence in the Contract Record, "Engineering Responsibilities and Lay Administration," which has followed the leading article on the subject, has a unique interest and importance. Lay administration is a world-wide disease from which every nation is suffering, and it is owing to this very fact of its universality that its ravages escape public notice. By the engineer, however, and especially by the municipal engineer, its evils are keenly felt, and the life of many a man is turned into a miniature Hades by the prevalence of numskulls and dummkopfs in the personnel of his Council. The expressions must be taken more or less in a Pickwickian sense. A man may be a very excellent grocer. He may have a perfect genius for bar-tending. But none the less when it comes to the conduct of the affairs of a city or a town his brain may in very truth become torpid, benumbed, dull, and unable to answer the strain placed upon it. He may, as has been said, be a very excellent grocer or bar-tender, but his efforts to get the hang of an engineering problem may well render the epithet "dummkopf" quite applicable, and not a whit more uncomplimentary than the truth usually is. The commission form of Government, executives of higher calibre, organization of the profession of municipal engineering, and the establishment of a Department of Municipal Administration are among the more valuable suggestions put forward by readers of the Contract Record; but there is one still more valuable that appears to have escaped their notice—one that has been mooted by the writer on more than one occasion and has brought much contumely upon his shoulders.

The Evils of Decentralization

Centralization and decentralization both have their attendant evils. In England the decentralization which has followed the introduction of the Local Government Act of 1894, for example, has been productive of very much that is evil. It has resulted (to take one phase of the subject) in the formation of a number of petty little districts, self-governed by local ignoramuses and busybodies and officered by men not one whit superior to ledger clerks and road foremen. The introduction of urban luxuries (to use one of the cant phrases of the local magnates who boss these pitiful shows) has spelt disaster. Rates have gone up to as high as 60 per cent. of rental value, with the inevitable result of a deadlock in building. Road maintenance has degenerated into a "sloppy" farce, sewage-disposal into a "stinking" joke, and refuse destruction into a "malodorous" comedy. There are districts where one individual holds every public post that there is, receiving as petty Pooh-Bah the [illegible] secretary.

A Department of Municipal Administration

The policy of centralization, on the other hand, has kept together an ineptitude such as the Local Government Board, with its red-tape formalities, medical faddisms, and inspectorial idiosyncracies. John Burns did try to do something during his years of office, but the permanent officials were up against him, and from the juniors downwards the spirit of opposition was ineradicable. Class prejudice may account for much, but there was also the hatred for the man who, in such an exalted position, put a shoulder to the wheel himself. Much more honoured was a certain predecessor in office, who would necessitate lengthy journeys by the staff to the Moors and eleswhere when an occasional important document (there **are** such things) required his personal signature. The Local Government Board is, of course, more of a Poor Law than a municipal body, and the pity is that it dabbles in such matters as engineering or sanitation at all. The creation of a Department of Municipal Administration would be as welcome here, in England, as it would be in Canada. England is, however, already in the rut unfortunately, and vested interests will see to it that nothing of a practical nature be done. Canada is still on a comparatively good surface, and it will be her own fault if, with the 'orrible example of the Local Government Board before her, she allows herself to be bogged and quagmired in a similar way. So much for the suggested Department of Municipal Administration.

A Working Triumvirate

Local autonomy must necessarily be preserved in some form or another. "The usual council," says Mr. Macallum, "is generally led by three or four men more or less familiar with city business," and, this being so, why not, he adds, "carry on the business by that number?" The carrying of Mr. Macallum's point to its logical conclusion will place that gentleman on the side of the writer in the daring suggestion to which reference has already been made. The three or four men who are most familiar with city business are the clerk, the engineer and the sanitary inspector. The others simply don't count at all. Mayors, aldermen, chairmen of committees—even medical officers, in the majority of cases—may be regarded as superfluous or purely ornamental. Why not then, to use Mr. Macallum's words, "carry on the business by that number?" To obtain an "executive of higher calibre," by any system of popular voting, is out of the range of practical politics. Selection would lead to "graft" if the offices were to be purely honorary; and the alternative is either the Commission form, which would prove but little better than the present form, or—and here enters the "daring suggestion"—the abolishment of Council altogether. Let the clerk, the engineer and the sanitary inspector act as the local coalition government, the work triumvirate, subject only to the control of the Department of Municipal Administration. At once would the status of all the officers be raised and with increased and increasing responsibility men of higher calibre would enter the profession of municipal engineering, while those already engaged in it would have every incentive to improvement. The organization of the profession would [illegible]

[illegible] improve instead of protection. A system which [illegible] men arraying themselves as a protection [illegible] the terrible results of doing their duty [illegible].

The Fallacy of Numbers

The cultivation of the social spirit in the members of a professional society is eminently desirable. Even the most hirsute individual must occasionally unbend, and the wagging of bearded chins in solemn conclave may be agreeably varied in several ways. But there are times and places for everything, and the merry quip and jest which may beguile the tedium of a smoking concert or the enervating dissipation of an "al fresco" luncheon are sadly out of place at an annual convention. Here, there is important work that should be done, and none should pass without some indelible record being placed upon the history of the society. As has been well said editorially, in speaking of the recent annual convention of the Canadian Society of Civil Engineers, "such an event should prove an annual inspiration to every member of the profession." As such affairs go here, in England, the attendance from point of numbers was good, and the visitors did not swamp the members, as was the case at a meeting of a certain Institution in London, when the chairman, the secretary, three members and five press representatives alone were present. The unfortunate fact is that mere numbers do not count for such; it is interest, enthusiasm, self-control and solidarity that are wanted. There is a certain class of man that will speak on everything; there is another class that maintains an obstinate silence on every subject, even upon such as it is most qualified to discuss. There is the man who attends a convention because he feels that he ought to show himself at a meeting now and again, and there is the man who attends merely because he wants a day off. There are even men who really do not know why they do attend, unless it is upon the off chance of shaking hands with a friend or two or doing a bit of business in the town visited. What is wanted are men who have the interests of their society sincerely at heart, who regard a meeting as a red-letter event, and whose enthusiasm is not of a day but of all time. These it is hard to find. "While the growth of the society in numbers has been very satisfactory," one reads, "there has been no corresponding growth in the enthusiasm of its members, as evidenced by attendance at the meetings, by the preparation and contribution of papers, or of discussion on the papers submitted, but rather the reverse."

The Premier Institution

This is a gloomy statement indeed; and yet the Society may take heart, for apathy and indifference are the common lot of professional societies the world over, once the early enthusiasm has simmered down. Even the great English Institution of Civil Engineers is devoid of enthusiasm. It works on its bank balance and its record in the years that have gone. It is to all intents and purposes a preserve for top dogs, who from their seat upon the Council hand out jobs to the small fry, who are kept from getting them for themselves by a beautifully balanced system of professional etiquette. An engineer who is not a member (or associate member) of the Institution is practically debarred from a livelihood; hence the guineas annually flung into the funds largely for the behoof of the charmed circle. It would be ridiculous to say that the ordinary member did not get some return for his subscription, but it is beginning to be appreciated very keenly that such return is not commensurate. As to the boasted "Proceedings," the volumes can very shortly after publication be purchased for a few pence each, and the writer now has a set extending over a number of years which will have to go at waste-paper prices shortly if no offer comes along.

"Class" Distinctions

That "nothing succeeds like success" is not true of professional societies. It is success that spoils them. The founders of a society will possibly be men actuated by no thought of reward and acting solely for the benefit of their professional fellows. With increasing numbers the founders become lost to sight. Pushing individuals thrust themselves upwards, and the evil influence of domination begins to be felt. Then cliques are formed, and the whole work of the society falls into the hands of a few, who take in rotation all the posts of honour available. Back-scratching and log-rolling become rife, and the younger men—the men for whom the society was called into being—are cold-shouldered and driven to the wall. Only by encouraging the students and young associates can a society flourish. They are its life-blood, and if the stress fails lethargy and collapse ensue. But the youngsters are bashful and reserved; they lack experience, and they hesitate to express their views. It is just these things that have to be overcome, and it is up to the seniors, the men who have made their mark in the profession, to draw them out. There are many ways in which this can be done, but patronage and condescension are not among them. There must be an equality among all classes in the society, at any rate when assembled at a meeting or in convention, and the younger men must be made to feel, beyond any shadow of doubt, that this is so. The whole practice of "class" distinction is open to condemnation. Professional societies do not differ so much from trading concerns as they perhaps ought to; but facts must be faced as they are, and what honour there once was in admittance has been discounted of late years in more ways than one. Equality within the four walls of a society must inevitably add to its influence for good. Dignity is after all but a very unsubstantial form of diet.

A lecture was recently delivered by Mr. Marconi in Rome before the King and Queen of Italy, members of the Italian Government, both Houses of Parliament, and the Diplomatic Corps. He described the progress which had been made in wireless telegraphy, and the difficulties which had been overcome since his previous lecture in Rome in 1903. His voyage to South America on board the Principessa Mefalda had illustrated that communication in a north and south direction was easier than communication in an east and west direction. Mr. Marconi described his new system for generating continuous waves and its use in wireless telephony. He then described the apparatus for producing waves, divided into regular groups, and dealt with the improvements effected in receivers, giving a practical demonstration of the reception of messages in the lecture hall from Poldhu, in Cornwall, and Tripoli. Mr. Marconi finally described the practical applications of radio-telegraphy to all types of vessels, including submarines, as well as its uses in war and peace. He concluded with an acknowledgement of the help which he had received from the King and Queen of Italy.

The C. P. R. Double-Track Tunnel through Mount Macdonald, B. C.

FIVE hundred men are engaged day and night in constructing the five-mile double-track tunnel through Mount Macdonald, one of the peaks of the Selkirk Range in British Columbia. The bore will be the longest railway bore on the American continent and will obviate the present necessity of using two long spiral loops on the western slope and many miles of snow sheds. The improvements are designed to effect a big grade reduction and the abandonment of one of the most costly section of railway, from an operation standpoint of view, on the entire C. P. R. system.

The new tunnel will shorten the route by four miles. The enterprise is officially known as the Rogers Pass tunnelling scheme, and the work and related improvements will involve the expenditure of more than $10,000,000.

Since the company opened its transcontinental line through the mountains of British Columbia, it has expended millions of dollars in protecting and renewing its tracks, on extra locomotives used to haul trains up the heavy grades, and in coping with snowfalls and other physical handicaps which keep a large force of men and a large amount of expensive equipment busy nearly all the year. At Rogers Pass, close to the summit of the Selkirks, the company maintains large engine sheds, shops, snow ploughs and outfits ready for service on both sides of the Selkirk Range. For many years the railway company has been gradually effecting a reduction of its gradients and improving its main line generally. Four years ago two spiral tunnels were bored through Mount Cathedral and Mount Ogden in the Rocky Mountain range, eliminating what was known in railway circles as the "big hill" between Field and Hector.

The C. P. R. decided on the Rogers Pass tunnel undertaking and relating double-tracking work last spring, preliminary operations having been started in June. Before the work could be commenced on the excavation for the approaches, sidings had to be installed on either side of the mountains, camps established, trails and roads built, and a thousand and one other organization details given attention. Boring operations on the "pioneer" bore were commenced last autumn and a start was made a short time ago on the main tunnel from the eastern portal.

The new location for the line under the Selkirks branches off from the present route near Cambie, three miles west of Glacier, and at a point close to the commencement of the "loops" going west. The camp at the western end of the work is gained by two routes—by following the siding, or by an excellent road built by the Provincial Government, which leads from Glacier House down the valley and passes near the scene of the work. Following an even grade from Cambie the approaches to the tunnel run in an almost straight line to the base of Mount Macdonald. A large amount of excavation has been done and the material originally intended for dump filling has been found necessary for the roadbed.

The western portal will be located about 1,700 feet below and a short distance west of Glacier House. The main passage will provide for double tracks and the approaches from both ends will also have parallel lines. The tunnel will be 29 feet wide and 23 feet high, space for lining the walls, where necessary, being provided by extra excavation. The inside of the tunnel will be timbered and reinforced with concrete where required. The exact material in the heart of the mountain will only be determined as the boring proceeds, although it is expected that strata of different kinds of rock and earth will be encountered on the way through. Two big steam shovels, one of them scooping up as much as ten tons at once, are to be seen at work in the cutting which will lead up to the portal of the passage. The tunnel will follow a straight line under Mount Macdonald, emerging in the Beaver Valley at a point about 1000 feet below the present line, which reaches the summit by a gradual incline on a route notched out on the eastern slopes. The eastern entrance is situated almost immediately below Hermit, a flag station east of Rogers Pass and nearly 47 miles west of Golden. Up to the timber line a space has been cleared between the trees, posts being planted to mark the path which will be taken inside the mountain. A centre line has been mapped out right up to the top of the peak, on the apex of which is a pole with a signal flag, from which observations may be taken from both the Illecilewaet and Beaver valleys.

[illegible] Selkirks adjoining Mt. Macdonald.

Mount Macdonald can only be climbed from the west side, as it drops down practically sheer on the western slope. When the signal flag was being planted on the extreme summit, last August, the staffs of engineers at the eastern and western camps sighted their instruments from both valleys and checked up their previous calculations in order to ensure perfect accuracy in projecting their respective bores. The pole at the summit indicates the alignment of the tunnel, while a route surveyed around the [illegible] mountain [illegible] exact location of the tunnel will be determined by the two courses mapped out over and around Mount Macdonald and by mathematical calculations. The highest point reached by the proposed tunnel will be 3,795 feet above sea level, or 4,065 feet from the extreme height of the peak. The passage through the mountain will have a gradual rise of one per cent. to the "interior summit." After passing through the tunnel the railway will cross Bear Creek, near the eastern portal, and follow the course of the Beaver River, ascending to Six-Mile Creek, the junction point ten miles east, by an easy grade. Stoney Creek and other mountain streams will be forded close to the base of the slopes.

The contractors for the tunnel scheme are applying an entirely new method in tunnel work, projecting what is known as a "pioneer bore." This is a small preliminary shaft, seven feet by nine, which will parallel the course of the main tunnel fifty feet distant and be bored from both ends at the same time. The idea is in the nature of an experiment and was decided upon only after careful calculation and mature consideration.

The loop approaching the great mountain.

One of the reasons for the adoption of the new plan was the fact that the C. P. R. wished to have the main undertaking finished by December 31, 1916, three years and a half from the time the work was started. With the "pioneer bore," the work will be greatly facilitated. Side drifts will be excavated leading into the course of the main tunnel, and drillers will thus be enabled to attack a number of points at once. While blasting is proceeding in one part of the shaft the workers will be able to continue their activities in another shaft instead of having to cease work each time a shot is fired, as would be the case with the one heading. The same applies to the excavation part of the work. Lines of cars loaded with material can be kept continually in motion from the various drifts, which would not be possible were the operations concentrated at one part.

Another advantage is the fact that the "pioneer bore" will act as a ventilating shaft, enabling the passage of a current of air through two bores and the connecting passages. It will also serve a permanent purpose in the same connection on the completion of the main tunnel.

One of the difficult engineering works carried out in conection with the tunnel undertaking was the diversion of the course of the Illecilewaet River. The stream, which during the spring freshets assumes the dimensions of a torrent—presented a great handicap, as its original channel crossed the location for the approaches at a point where a deep cutting had to be excavated to secure the necessary grade for the entrance of the tunnel, and then skirted the route for a considerable distance. While measures could have been taken effectively for carrying the tracks on trestles or bridges, there would still have been the danger of the river encroaching on the line or undermining the roadbed. It was decided, therefore, to change the course of the stream. To accomplish this and to prevent furture trouble, a deep trench nearly a mile long was dug on the left side of the approaches. This will act as a continuation of the original channel of the river, and will divert the stream past the cutting to a point where an arched culvert will turn the water under the tracks again into the old creek bed on the right side of the railway.

The tunnel contract covers eight miles of the improvement scheme, which will extend to Six-Mile Creek, and includes the construction of the line from the junction point at Cambie to a point about a mile on the other side of the eastern portal. A contract will be let later for the double track connections further east.

Model villages have been established by the contractors on both sides of the mountain. The buildings are all equipped with electric light, hot and cold running water, and other conveniences not usually found in the ordinary railway camp. Roomy dining rooms and sleeping quarters are provided for the men, the houses being connected with covered passage-ways raised above the level of the snow. The kitchens are well laid out and appointed, having concrete floors, among other aids to cleanliness.

Comfortable quarters for the clerical and engineering staffs of the contractors and the C. P. R. are provided in separate buildings. Several apartment houses and small dwellings are reserved for married men. There are stores at both camps, comfortable lounging rooms, post office and other institutions found in small towns. Emergency hospitals and surgeons are maintained at both villages and there is a regular police force.

Gangs of drillmen will be employed in three continuous shifts on the tunnel excavation work, which will be done from both ends at the same time. Work on the "pioneer bore" has been advanced at the eastern portal nearly a thousand feet into the base of the mountain, and a start has been made on the main bore from the east end. Operations will be commenced on

Entrance to "pioneer bore" Selkirk tunnel.

the preliminary shaft and the large tunnel at the western end at an early date. The excavations for the approaches at both sides are almost half completed.

The undertaking is being carried out for the C. P. R. by Messrs. Foley Bros., Welch & Stewart. Mr. A. C. Dennis is the superintendent in charge of the operations, while Mr. J. D. Shepperd, officially designated Assistant Engineer in charge of the Rogers Pass project; is the railway company's chief official representative on the ground. He makes his headquarters at the western camp, which is connected by telephone with the eastern camp and points along the line on both sides of the summit. Under Mr. Shepperd are two resident engineers, Mr. H. R. Phipps at the eastern end, and Mr. G. Macgilp at the west. The executive offices are at the western portal camp, and two entirely separate staffs are maintained by the C. P. R. and the contractors.

The camp at the entrance to Selkirk Tunnel.

Forms for Concrete Work

A PAPER on "Forms for Concrete Work" was read at a recent meeting of the Concrete Institute (London, Eng.), by Mr. Allan Graham. The author commenced by saying that we did not often hear of failures occurring in reinforced concrete buildings after their completion, but generally during their erection, and although all failures could not be attributed to defective forms, yet the forms were to blame in a sufficient number of cases to render the forms for concrete work an important element in securing efficiency in construction, and not merely in the utilitarian aspect. Although it was not the practice—in England, at any rate—for engineers to design their forms, that being generally left to the contractor, it was his belief, the author remarked, that an engineer, for his own protection, should at least set out some typical portion of the forms for the contractor's guidance, thus doing all he could to avoid failure in this direction at any rate. Of course, good forms alone would not ensure safety, and vigilance had likewise to be used in detecting bad work, bad design, and bad material.

Dealing then with terms used in concrete work, the author remarked that formwork was a term embracing all kinds of moulds or centering set up to give shape to the concrete or similar plastic material. It was so employed in America. There was a concensus of opinion in favour of the definition "formwork" as an inclusive term, owing to the real meaning of the term "centering" having a more limited application than was usually attributed to it. As the word "form" was the same, and had the same meaning in French, German, Italian, and Spanish, the author said he believed it would be agreed we were on safe ground if we accepted it for our purpose. The term had great merit, being superior to such terms as falsework or shuttering.

The contention that the engineer should prepare the design of formwork had much to recommend it. An engineer would generally have no hesitation in setting out the design of centering for a bridge or other equally important work, but for some reason or other the design of ordinary formwork which played such an important part in the cost of reinforced concrete was never considered. There was no doubt that a thorough understanding of the principles underlying the every-day practice of concrete form design was worthy of the best engineering talent. With this understood the problem could be analysed, the requirements realised, and the design decided upon that would be the most economical and efficient, due consideration being given to the salvage of materials.

It was not merely that a design for a specific case which would safely support a certain volume of concrete was required; it was rather the problem of designing a set of forms which could be erected, taken down, and many times re-used during the progress of work. The factors involved were many: such as the type of centering, the kind of timber, how much to centre at one time, and what clamps, bolts, nails, wire, or strap steel should be used. These things properly considered would repay the trouble taken and result in better and more economical work.

Various authorities placed the cost of formwork at anything from 20 per cent. to 60 per cent. of the total cost. The possibility of reducing this hindrance to the more general use of concrete ought to be sufficient inducement for us to give the matter close consideration. The great American constructional firms had struck out in many directions to reduce this cost to a minimum, and to this end the forms in most instances were designed in the drawing-office, at, we are told, a cost of 2 per cent. and a saving of 10 per cent.

The author then dealt with the kinds of timber that are used for formwork; the desirability of giving a camber to the bottom of beam boxes, and of carefully checking the measurements, to see that the concrete members were actually carried out as designed; the necessity of having joints close to prevent the mixture escaping; the remedying of cracks; the removal of forms; clamps and nails to hold the forms together; the repair and re-use of formwork; the number of sets required in order to get on fast enough with the work of building; the importance of carefully clearing forms of all sawdust, dirt, and chips before filling with concrete; the wetting of timber to prevent sticking; the use of sheet metal; the time for striking forms and methods of determining the strength. He then dealt in detail with forms for various parts of construction, as, for example, floors, beams and pillars, culverts, conduits, tall chimneys, silos, tanks, gasholder tanks, dams, domes, and bridges.

The following method for mixing the top layer of concrete floors has been successfully handled: Iron dust to the extent of 15 lbs. to 30 lbs. is mixed with 100 lbs. of the cement dry, and one part of this mixture to two parts of sand makes the slush for the top coat, which varies from one-half inch to one inch in thickness. It makes a hard and durable floor, thoroughly waterproof, and not slippery.

PROGRESS ON THE QUEBEC BRIDGE CONSTRUCTION

Substructure and Approach Spans Completed — Storage Yard and Contractor's Camp Established—Steel Received and Traveller Tower Erected

IMPORTANT progress has been made in the construction as well as in the design and fabrication of the $12,000,000 Quebec Bridge, and although the work is not yet imposing from the layman's standpoint, it has reached a stage and has included preliminaries that will permit rapid future progress. At the site the short approach spans and the difficult and costly superstructure for the main span have been completed, a camp established, contractor's yards laid out, plants installed and operations commenced in the storing of superstructure steel and the erection of traveller and falsework, thus providing for vigorous operation in the spring and for the erection of the main steelwork, which is now being fabricated and shipped to the site.

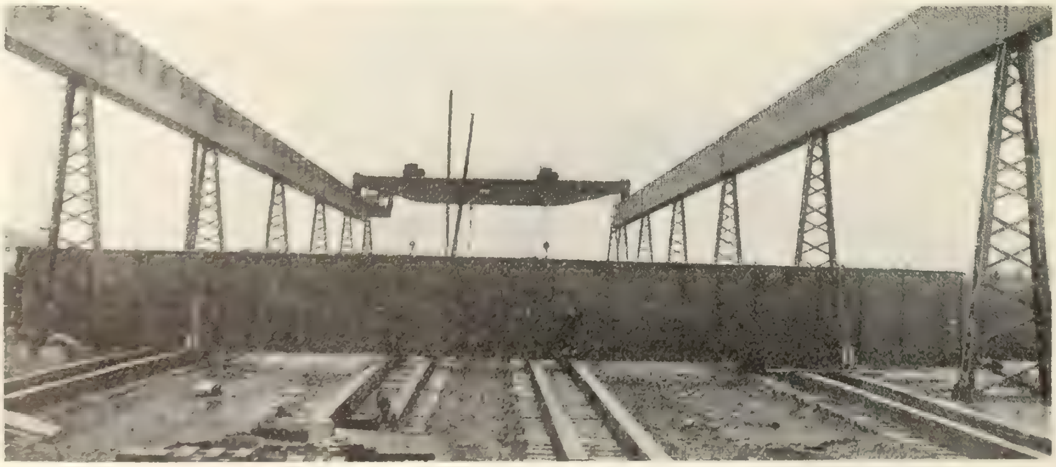
The two large main piers, located 1,800 ft. apart on the edges of the very deep-water channel, are of concrete construction with masonry facing and pneumatic-caisson foundations. The anchor piers, 2,830 ft. apart, are of similar construction, with foundations on solid rock above water level. They are a few feet eccentric from the old piers, so as to clear them instead of utilizing a portion of them, as was at one time intended. The old piers have been removed to low-water level, and part of the stone masonry contained in them has been used. The short approach spans at the north end of the bridge have been erected and standard-gage tracks on them connected with the railroad branch, so that material and equipment can be received and stored and the erection of the main spans can be undertaken as the falsework for the anchor arms is erected. The construction equipment is installed and the steel is at the site.

Erection will be commenced this spring at the north end of the bridge and at the south end next year, after which the work will progress simultaneously on both sides of the river until completion. At present the principal activities are on the north side of the river, but will be substantially duplicated on the south side in time to commence the erection there as soon as required by the programme of scheduled operations.

North Shore Plant

As the bridge site is in a rural district at considerable distance from towns large enough to provide convenient accommodations for the workmen, a construction camp has been established on the north shore to accommodate the erection force. Quarters have been provided for the engineers and other officers of the bridge commission and the contractors. The camp contains bunk houses with steam heat, electric lights and artesian water supply, besides which there are an office building, a commissary, kitchen, dining room, wash house, hospital, police station, repair shop and storage houses. Owing to the severity of the climate the working season for erection is limited to about six months, and the camp, which will be in service about four years, has been constructed with a view to durability and comfort for at least that length of time.

The power house is of fireproof construction and is equipped with four Ingersoll-Rand air compressors—



Storage yard with its 90-ton travelling girder crane.

one of which is intended to be kept in reserve—with a combined capacity of 2,000 cu. ft. of free air per minute. The compressing-current motors of 100 h.p. each, and two 250 kw. motor-generator sets are installed to reduce the 2,200-amp. current to 220 alternating current for the operation of the motors on the erection travellers. All of the principal installation is in duplicate and is proportioned so that there will always be a reserve.

The electric current is purchased by the contractor and is delivered on both sides of the river and connected by a cable across the channel so that either side may supply the other side. A duplicate plant will be established on the south shore of the river, thus providing for the eventual installation of four units, which, besides affording flexibility and reserve, were found to be cheaper than the installation of a single large plant with the required total capacity and excess.

The main travellers are each operated by mill-type General Electric motors. It is estimated that a total of about 500 h.p. on each side of the river will be required for all erection purposes when the work is in maximum progress, and that of this amount about 500 h.p. will be required to operate the air compressors which supply power for the pneumatic tools. Although a capacity of 800 h.p. is provided, it is expected that not more than 400 or 500 h.p. will be used at any one time.

Storage Yard

The storage yard is commanded by a two-trolley 90-ton girder crane of 81 ft. 3½-in. span, travelling on a runway 495 ft. long. The space commanded is crossed at one end by two standard-gage service tracks connecting with the bridge track and with the railroad branch. The remainder of the space between the runway girder is occupied by four full-length lines of double timber skids 4 ft. apart on centers, which have a capacity sufficient for the storage of all the steel required for either the anchor arm or the cantilever arm.

The girder crane and runway are substantially duplicates of those already installed in the storage yards of the fabrication shop in Montreal, and will eventually be removed there to supplement them. Excepting 33 ft. and 49½ ft. odd spans at the ends, the runway girders are 66 ft. long and are supported on battered steel columns 7 ft. wide transverse to the tracks at the base. Each column is made of four corner angles united by lattice angles and having the upper ends bent vertical and riveted between the inner faces of the double runway girders. The columns on one side of the runway are staggered with those on the opposite side so as to allow members longer than the width of runway to be moved to any position without turning.

Erection of one of the main travellers was commenced on shore at the north end of the bridge last fall and was completed to the top of the tower, a little beyond the point shown in the accompanying illustration, before work was suspended for the winter. The traveller, about 200 ft. high, has clearance between the trusses of the permanent structure and is of heavy riveted construction with a vertical tower of rectangular cross-section made with four vertical posts X-braced on all faces and horizontal bracing at each panel point.

The base of the tower is extended by trusses projecting from one side and is supported by four six wheel trucks running on two [illegible] ft. gage tracks. A pair of vertical trusses framed into the top of the tower cantilever 50 ft. front and rear, serve as runway girders for a pair of travelling cranes of 110 tons capacity with nickel-steel girders. These girders cantilever beyond both sides of the traveller so as to extend across the trusses and command them with their 55-ton trolley hoists.

The traveller weighs about 930 tons, or, with its full equipment, about 1000 tons. It will be provided with electric passenger elevator and hoisting apparatus. After erecting the falsework, the anchor arm and the cantilever arm on the north side of the river will be dismantled and reassembled at another site for the erection of the 640-ft. 5,000 ton center suspended span on shore falsework.

The fabrication of the 7,400 tons of steel in the floor system of the entire bridge and of the 1,400 tons of inside falsework and 470 tons of outside falsework for the north shore has been almost completed, and on February 1 about 8,000 tons of steel had been shipped to the site, besides 1,000 tons of floor system which had been completed and which are still stored at the fabricator's shops.

The work is under the direction of the board of engineers, of which C. N. Monsarrat is chairman and chief engineer. It is being executed by the St. Lawrence Bridge Company, of which Phelps Johnson is president and G. H. Duggan, chief engineer.

BRIDGE RIVETS OF UNUSUAL SIZE

Fabrication of the very large members of the new Quebec Bridge required the driving of numerous long carbon-steel rivets of large diameter, and unusual pains have been taken at the St. Lawrence Bridge Company's shop in their perfection and in the demonstration of the results obtained in driving them. Satisfactory results are reported to have been secured for the 1⅛-in. iron rivets in the pedestals under the main vertical posts. These rivets have a 9-in. grip and are 12 in. long before driving, thus requiring great efficiency in the machine and making it a difficult and costly matter to attempt cutting out and redriving, so that it is essential that they should be satisfactory at the outset.

The requirements are for the rivets to be driven at a cherry red. The cylindrical holes are drilled or reamed to a uniform diameter and the rivets are tapered about 1-32 in. in 12 in. from the end near the first head so as to completely fill the hole there when inserted. The points are chilled by being dipped in water before driving, thus tending to increase the upset in the middle of the shank, and the first heads are made long, affording a sufficient excess of metal to insure the formation of a 1-16 to 3-16 in. burr next the metal.

These rivets are driven as fast as those driven at a much higher temperature, and are not subjected to as much stretching by the springing of the riveted plates as when rivets are hotter. The driving has been so successful that practically no rivets have been condemned and cut out. Heating the rivets to a very high temperature for driving is objectionable on account of the scale that is formed and because the metal is then too soft to transmit the compression and produce a sufficient upset a long distance from the driven head.

The shop rivets are driven with pneumatic yoke machines and the field rivets will be driven with pneumatic guns and special pneumatic [illegible] [illegible] a pneumatic hammer mounted in the [illegible] and operated during the first part of the driving. The plunger is controlled by a special valve, which first sets it up against the riveted member and maintains the pressure, after which the hammer may be simultaneously operated until the rivet is nearly driven from the opposite end, when this hammer is stopped and the static pressure continued until the driving is completed by the gun.

Specimen 1⅛ in. rivets 12 in. long were driven through several plates by the 80 and 100-ton yoke machines and by the pneumatic hammers. Afterward the plates were planed apart through the center line of rivets and those driven by the pneumatic hammers were found to be as good as those driven by the yoke machines and almost indistinguishable from them, all of the rivet holes being completely filled.

PRELIMINARIES TO ERECTING A GREAT BRIDGE

In this country where the shop fabrication of steel bridges is highly developed, where facility of erection is recognized as an important element of design and where extensive equipment is devoted to the erection of the superstructure, the field work on even very large spans is so rapid that it is generally measured by weeks or months and seldom, except for the very largest spans, involves very remarkable plant or is far removed from the commonplace. In notable contrast to this almost routine work is the erection of the Qeubec Bridge, the greatest span in the world. Over 60,000 tons of steel are to be assembled in three spans, of a combined length of 2,830 ft., 150 ft. above the water. The river is 200 ft. deep, with a tide of 15 ft. and a current of 8 miles. Pieces weighing 185 tons and compound members nearly 300 ft. long, weighing more than 1,200 tons, are to be handled in mid-air and assembled and maintained with precision. Two cantilever arms must be built out self-supporting for 580 ft. beyond their piers and remain exposed for months to the severest storms and a 640-ft. double track 5,000 ton railroad span must be built at a distance, floated to the site, raised 150 ft. and connected to them with great speed and accuracy.

It is expected that all this can be accomplished in four years of elapsed time, or less than half as much working time, since work must be discontinued during the long and severe winters. To do this, elaborate provision is now being made for all the construction operations, the schedule is prepared for the successive steps and the details of operations are being minutely worked out, instructions prepared and machinery, tools, supplies and every needed facility provided in advance, due regard being had for the utilization of certain parts of the equipment repeatedly to avoid unnecessary duplication. Even with this care the cost of installation of the whole erection equipment will considerably exceed $500,000, exclusive of maintenance, supplies and labor, so that the total erection expense reaches thousands of dollars a day for the actual working time.

The structural steel in the falsework, travellers and yard equipment for temporary work will be about 4,000 tons; two 800 h.p. electric power plants and two sets of air compressors will be required; two 1,000-ton steel tower-travellers, 200 ft. high, must be erected and equipped, and a massive steel falsework, more than equivalent to permament railroad viaducts, must be built not only for the temporary support of the permanent trusses, but also for the separate support of the great travellers. Barges and falsework must be built for the 640-ft. span, and special hydraulic apparatus provided for lifting it to place. Provision must also be made for the maintenance of a large force of men at the site.—Engineering Record.

THE civic investigation, now closed, into the cause of the break of Montreal's water conduit was characterized by a remarkable divergence of opinion between experts. Broadly speaking, the experts were divided into two camps, one attributing the accident to the poor design of the conduit, and the other to the excavation of earth in the widening of the aqueduct, thus undermining the conduit. Messrs. Jamieson, Lea and Heckle, the engineers who reported on the break for the city, gave evidence to the effect that the conduit failed to stand the conditions for which it had been designed; the concrete was good, but the metal reinforcement was not strong enough. It was admitted, however, that the excavation of the earth was a contributing cause to the break. Opposed to the views of the above experts, which was supported by the evidence of others, were the opinions of Col. H. R. Lordly, chief engineer of the Lachine Canal, Mr. G. Janin, and others. Their evidences went to show that the break was due to the excavation on the aqueduct side, making an unbalanced load. The use of the drag line excavator was also criticised, it being further declared that the design of the conduit was good. Mr. M. J. Butler, president of the Canadian Society of Civil Engineers, and head of the Armstrong Whitworth Company of Canada, expressed the opinion that the excavation could have been done safely by building a retaining wall in short sections, as the excavation proceeded. The wall should have been built especially opposite to such places where the conduit was too close.

Grading has been started on the last section of the Canadian Northern Pacific Railway on the mainland of British Columbia. According to a statement made a few days ago by Mr. S. H. Sykes, assistant chief engineer, the entire line will probably be ready for the rails next july. About sixty per cent. of the grading has been done on the twenty-mile section west of Albredo Summit, and track laying will be commenced from the present end of steel ten miles west of the Yellow Head Pass, early next month. Between the present completed sections of the line several bridges are now under construction.

The salary of Mr. Alfred Craven, Chief Engineer of the Public Service Commission, First District, New York City, has been raised from $15,000 to $20,000 per annum, making his salary the highest of any engineer in the service of New York City or the State. In the capacity of chief engineer of the commission Mr. Craven has charge of all the work of the dual subway and transit system now under construction, involving the expenditure of $167,000,000.

A deputation of about two thousand from Western Ontario waited upon the Premier and the Cabinet at Ottawa a few days ago to urge upon the Government the necessity of proceeding immediately with the deepening of the St. Lawrence River, to make an ocean waterway. The deputation also urged that the projected 6,400 miles of Hydro Radial lines in Ontario should receive the same government subsidy that other railways on the continent received.

A Self-Anchored Suspension Bridge at Cologne Embodying Interesting Features

A NEW highway bridge presenting many interesting features is in course of erection over the Rhine at Cologne. The bridge is what may be termed a self-anchored suspension bridge and was designed by the Maschininenfabrik Augsburg-Nurnberg A.G. The suspension chains, instead of being led to land anchorages as usual, are anchored by bolts to the stiffening girder itself and put it under compression. The stiffening girder is continuous over four supports, so that the system as a whole is three times statically indeterminate. This will be the first bridge of large dimensions built in Europe (and perhaps in the world) of this type. The designers, prior to entering upon their calculations, made experiments upon a model bridge with a view to satisfying themselves as to how the stiffening girder would fail under compression. Under test loads the stiffening girder was found to cripple between panel-points, and the calculations for crippling were made upon this basis.

The entire width of the deck, including one roadway and two footways, is between the stiffening girders, so as to provide clear, uninterrupted passage from side to side, giving pedestrian traffic the facility of crossing over at will from one footway to the other. As the stiffening girders project above the deck, this transverse communication would not be possible with footways cantilevered out.

Every consideration has been given in the design to providing an unobstructed deck and free outlook upon the river, two points of paramount importance from the point of view of the public. The stiffening girders are made to serve as bulwarks or railings; their top angles are at the uniform height of 36 in. above the footways for the whole length of the bridge.

The fixed bearing of the stiffening girders is on the west pier; the other three bearings (east pier and both abutments) are movable longitudinally.

In contrast to an ordinary suspension bridge with land anchorages, the deformation of this structure due to loading has no appreciable effect upon the internal stresses—that is, the internal stresses are the same whether the calculations are based upon the original system diagram or upon the deformed one. Further, under a temperature change that is uniform in the whole bridge no additional stresses are induced, as the geometric figure of the structure always remains similar.

Main Dimensions

The main dimensions of the bridge are as follows:—mid-span, 605 ft.; side spans, 302.5 ft. each; width between stiffening truss, centre to centre, 62.6 ft. The approaches are of reinforced concrete construction and are slightly wider (66.7 ft.) between the railings.

This will be the first large bridge to be built in Europe in which nickel steel is to be employed. The approximate [illegible] of the different [illegible] are: nickel steel, 6,500 tons; carbon steel, 2,200 tons; cast steel, 220 tons.

The permissive working stresses are:—

	lbs. per sq. in.
(a) Mild Steel	
(1) Road and footway construction	11,400
(Under steam-roller loading) ..	14,200
(2) Windbracing	14,200
(3) Rivet shear. For road and footways	[illegible]
For main girders and windbracing	12,800
(4) Rivet bearing: Twice the shear values.	
(b) Nickel Steel	
(1) Floorbeams	17,000
(Under steam-roller loading) ..	23,400
(2) Suspension chains, vertical load only	25,000
Vertical load, wind and temperature	30,700
(3) Stiffening girder	23,400

Stiffening girders.—Each stiffening girder has one fixed bearing on the 12th panel point (Fig. 1), the other three bearings being movable, and is arched upwards to improve its appearance. It is of inverted U section with a top flange-plate, the bottom being open to facilitate inspection and repainting. For a comparatively short length (for the first three panels) the top flange plates are discontinued so as to allow the suspension chain to be brought in between the webs. At the ends of the stiffening girders the suspension chains are anchored by bolts 2 ft. in diameter. The web plates of the stiffening girder are from 126 in. to 216 in. deep, splices being necessitated on the centre line. Rigid internal diagrams are provided at frequent intervals, and the whole girder has been carefully proportioned to withstand the buckling tendency of the 4,000-ton load induced by the suspension chains.

Suspension chains and hangers.—The chains are formed of nickel steel links connected together at the panel points by 12-in. bolts, except near the ends where larger bolts are used because the links are fewer and wider. The links are not of the usual American eye-bar type, but are formed as plates with parallel edges, a hole being bored near each end to take the pin and reinforcing plates being provided to strengthen the eyes. A bearing pressure of 45,000 lbs. per sq. in. and a tensile strength of 23,700 lbs. per sq. in. at the weakest section are allowed. The chain has a parabolic curve with a dip in the middle span of [illegible] ft. (one-tenth of the span) and 75.8 ft. in the side spans. The number of bars forming the complete links of each chain vary from six to twelve, their thicknesses varying from $\frac{7}{8}$ in. to 1 in. Towards the ends the number of links decreases, but the width increases to keep the area constant, the maximum width being 59 in.

The hangers are $5\frac{1}{2}$ in. in diameter, each having a turn buckle in the centre for adjustment of length during erection; they are connected to the chains and to the stiffening girders by pins of $5\frac{1}{2}$ in. diameter. It was the original intention of the designers to form every third hanger as a built-up riveted member, in [illegible] line of round bars and to make in a distant view a more prominent connection between the chains and the stiffening [illegible] The authorities [illegible]

By [illegible]

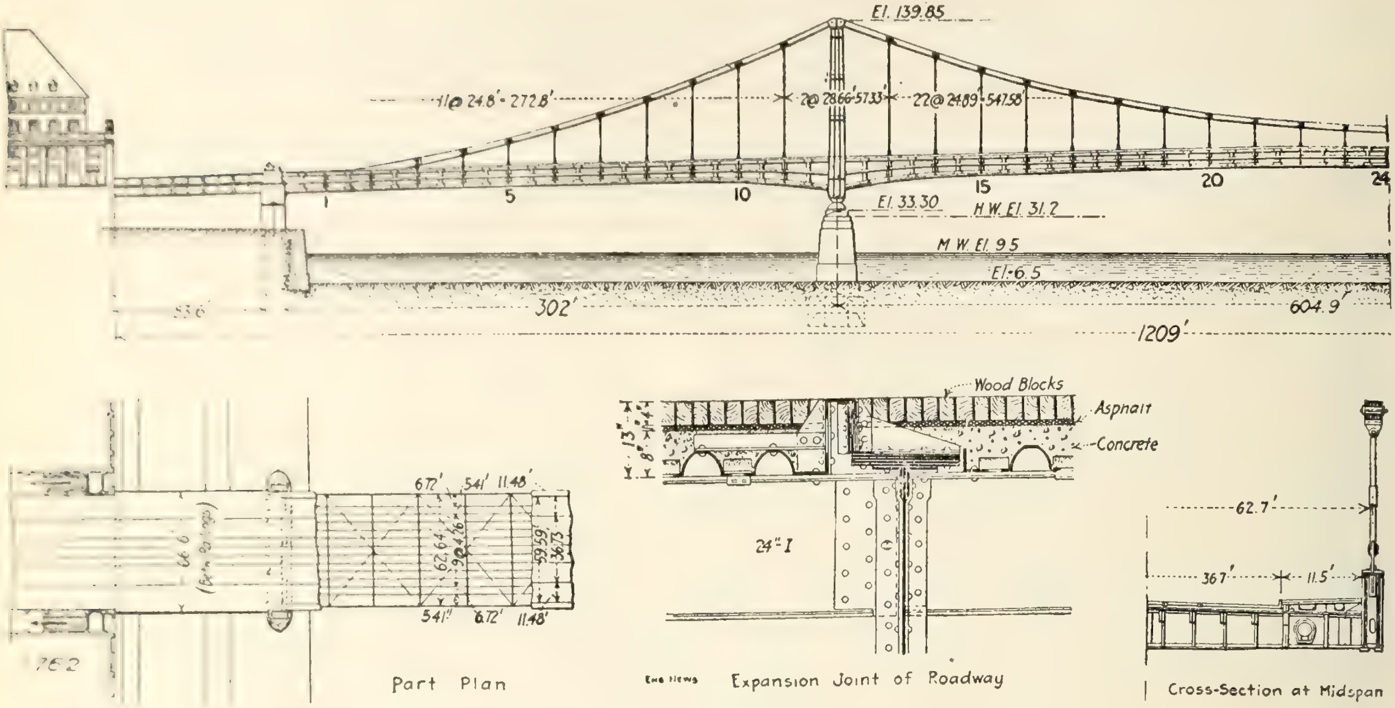


Fig. 1—Cologne Bridge.

opposed to the suggestion. To give lateral support against wind pressure to the suspension chain at the centre, a rigid member is used in place of a pivoted hanger.

Towers.—The general form of the tower is fairly clearly indicated in Fig. 2; the posts are liberally stiffened with internal diaphragms, and have manholes to facilitate inspection and painting. The maximum load per tower is 3,600 tons, and, in addition, there are to be carried bending moments due to wind pressure. The stiffening girder passes through a slot in the base of the tower post and rests upon a roller-bearing inside the tower.

Bearings.—The bearings at the abutments are not only movable, but are arranged to take up either downward pressure or uplift. The bottom roller, 12 in. takes the positive loads. Uplift is taken up by three rockers on top, acting against a shoe which is held down by four anchorage bars. The maximum uplift per girder is 440 tons; each anchorage bar is proportioned for 110 tons pull.

The bearings of the stiffening girders at the towers are built up of top and bottom castings machined to spherical shape. The contact surface has a diameter of 28 in. The top saddle casting is securely bolted to the tower post. Fig. 2 shows this bearing.

Windbracing.—The windbracing is located under the floorbeams. The distribution of wind load is as follows: wind pressure on the hangers distributes equally between suspension chain and stiffening girder. Wind loads on the roadway are taken up by the lateral system. Wind pressure against the chain is transferred at five points, tower tops, abutments, and rigid hanger frame at mid-span.

Roadway.—The roadway is of wooden blocks on a concrete base, while the footway is of asphalt on concrete. In every fourth panel the roadway is divided by an expansion joint, so as to be less affected by the

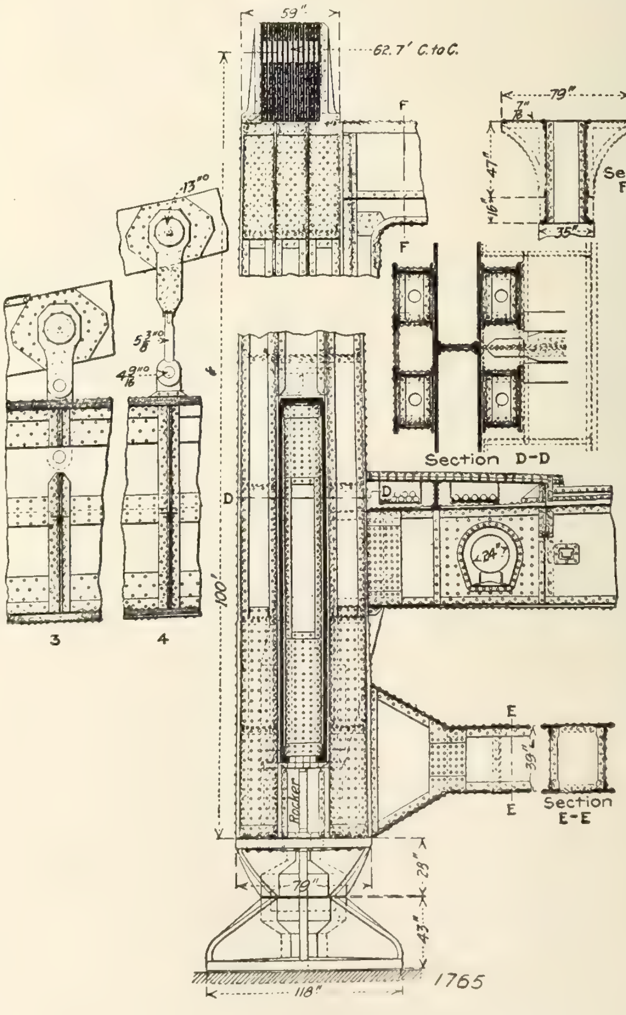


Fig. 2 -Cross-section at tower.

elastic deformation of the main system. The drainage water is carried by longitudinal gutters to the bridge supports and there discharged by downpipes.

An inspection wagon running on the bottom flanges of the stiffening girder is provided for inspection and repair purposes.

As the bridge has no land anchorages, the pull in the suspension chain cannot be taken up until the stiffening girder is erected and ready to be put under compression. The erection of the stiffening girders and the chains will therefore proceed simultaneously on special staging, and it will be so conducted that the stiffening girder is completed first.

Though the completed bridge is statically indeterminate in the third degree, it will be erected as a determinate structure; to this effect three hinges will be built into the stiffening girder; at the towers and at mid-span. Besides insuring absence of undesired initial stresses, this also simplifies the calculation of the erection stresses and deflections. When the stiffening girder is finished and the suspension chain connected thereto, every third hanger will be coupled up. The staging carrying the chains will then be removed and the remaining hangers coupled up and adjusted by means of the turnbuckles to bring the pin points into their correct positions, after which the splices in the webs and flanges of the stiffening girder at the three hinge-points will be riveted up.

Operation of Small Rapid Sand Filters

Determining Proper Quantities of Coagulants and Hypochlorite for Varying Conditions of Turbidity, Color and Alkalinity

By H. P. Setton[*]

In connection with the operation of small rapid sand filters, the writer has felt for some time the need of a discussion of the whole problem from the viewpoint of the man in direct charge of the operation. As he pointed out in a paper recently presented before the New England Water Works Association, small water purification plants are often poorly designed and more often poorly operated. The operator is not, as a rule, responsible for the design and while in the matter of operation he often makes mistakes, they are in the majority of cases due, not to carelessness or neglect, but to ignorance or lack of training.

A rapid sand filter cannot be operated by any set rule, day in and day out, for the reason that the character of the water to be treated does not remain constant. Moreover any set of rules which might work successfully in one location would perhaps prove an absolute failure in another.

With the above facts in mind, an attempt will be made in the following discussion to outline the best methods of operation as shown by the writer's experience. The processes will be taken up in regular sequence, beginning with chemicals and coagulation, and each step will be discussed thoroughly before going to the next.

The matter presented is designed to be particularly useful to the small plant having no laboratory control, as this is the type most generally mismanaged. It is believed, however, that those in charge of larger plants may find something of profit in the comparison of their methods with those given here.

Chemical Treatment

Coagulation and Coagulating Chemicals.—The question of proper coagulation and sedimentation, which is of prime importance in the operation of rapid sand filters, is often the least understood of all the steps in the process and therefore receives less attention than it should.

In order to effect efficient removal by the filter of either bacteria, turbidity or color, it is essential that a good precipitate be formed which will settle and drag down with it a large per cent. of all the above substances and yet leave enough flock in the water entering the filters to form a suitable slime layer on the surface of the sand.

By far the greater number of small plants use sulphate of alumina as the coagulent, and this discussion will therefore be confined to that chemical.

In order that coagulation or precipitation may take place it is necessary that the raw water contain sufficient alkalinity to combine with the sulphate of alumina and form the flocculent aluminum hydrate. By alkalinity is meant the temporary hardness of the water. It is usually expressed in parts per million of calcium carbonate. Many waters contain at all times alkalinity much in excess of that needed to effect coagulation, while others vary greatly at different times. In most streams the alkalinity is the lowest at times of greatest flow with its resultant high turbidity. For this reason alkalinity tests should be part of the regular routine operation. The test is not a difficult one, requires but a small amount of apparatus, and with a little practice can be carried out by the filter attendant. The apparatus and solutions needed and the method of making the test as prescribed by the "Standard Methods of Water Analyses" of the American Public Health Association are given below. (The book just mentioned should be in the hands of every man in charge of the operation of a rapid sand filter plant.)

The apparatus needed for the alkalinity test is as follows: One glass stoppered bottle holding about 250 cubic centimeters, one burette for titrating, one 5 cubic centimeter pipette, one 2½ cubic centimeter pipette, one 100 cubic centimeter graduate. The technique of making the test is as follows: 100 c.c. of the water to be tested is placed in the bottle; to this is added 2½ c.c. of erythrosine solution (0.1 gram of the sodium salt is one liter of water), and 5 c.c. of chloroform (neutral to erythrosine). The mixture should now be well shaken and, if the pink color persists, fiftieth normal (N 50) sulphuric acid should be added from the burette, a little at a time, shaking thoroughly each time until the pink color disappears. Each 0.1 cubic centimeter of sulphuric acid used is equivalent to one part per million of alkalinity expressed in terms of calcium carbonate.

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[*] Of the U.S. Public Health Service.

One grain of sulphate of alumina per gallon will theoretically reduce the alkalinity about 8 parts per million. When treating waters with high turbidity, however, it is often found that this theoretical amount is much reduced, probably because the turbidity absorbs a certain amount of the chemical before coagulation takes place. In conditions such as this it will be found advisable to add a small amount of chemical and then, after a period of sedimentation, to add another small amount.

It is essential that the water be alkaline after treatment, as otherwise free alum will be found in the water. Free alum is detrimental to health, besides rendering the water extremely corrosive and also preventing its use in some industrial processes, such as dyeing. It sometimes happens, when large amounts of chemical are added to a very turbid water, that the alkalinity is not all used up, but the water nevertheless contains free alum. At such times, or whenever the presence of free alum is suspected, the following simple test will be found convenient: Fill a test tube half full of filtered water. Add four or five drops of Haematoxylin solution (1.0 ounce Haematoxylin to 8.0 ounces of water), or sufficient to give a bright red color, and then add one drop of dilute acetic acid. If the water is free from alum, the color on the addition of the Haematoxylin will be bright red, which on the addition of the acetic acid will turn to a straw yellow. If there is alum present, the color on the addition of the Haematoxylin will vary from a greenish brown to a bluish black, which will not change on the addition of the acetic acid. This test will show free alum in the proportion of one part in five million.

In order that the filtered water shall always be alkaline, it is not advisable to add more sulphate of alumina than will reduce the alkalinity three-fourths. If this amount of chemical is insufficient for proper coagulation, it will be necessary to artificially increase the alkalinity. This is generally effected by adding to the raw water a solution of soda ash or crude sodium carbonate. One grain per gallon of this chemical is equivalent to about two grains per gallon of sulphate of alumina.

There are numerous brands and grades of these two chemicals on the market at varying prices, but it is believed to be economy to buy a good quality, especially of sulphate of alumina. The following specifications call for a chemical of high grade. These specifications, or very similar ones, are used in buying the chemical by almost all of the larger plants and should be adopted by the small ones also. It would be well to buy in large quantities and have the shipment tested to determine whether the specifications are being followed. The specifications are:

The basic sulphate of alumina shall be guaranteed to contain 17.5 per cent. of alumina (Al_2O_3), soluble in water, and of this amount at least 5 per cent. shall be in excess of the amount theoretically necessary to combine with the sulphuric acid present. It shall not contain more than 0.5 per cent. of iron (Fe_2O_3), and the iron shall be preferably in the ferrous state. The alum shall be crushed to pieces of such a size that they will pass through a ring three inches in diameter.

Solution Tanks.—The solution tanks, whether of wooden or concrete construction, should be provided in duplicate. The best method of dissolving the chemicals is to have in the top of the tank a V-shaped trough, either of wood or concrete, of a sufficient size to hold the necessary amount of chemical for a tankful of solution. Above and parallel with this trough should be a water pipe, perforated with numerous small holes, one row pointing directly downwards and a row pointing towards each side of the trough. By this method it is possible to so regulate the flow of water over the chemical that it will all be dissolved by the time the tank is full. If some such method is not used with the soda ash and instead it is dumped into a tank of water, it will crystallize and form a very hard, almost insoluble, mass in the bottom of the tank.

After the chemicals are entirely dissolved, the solution should be thoroughly agitated for a few minutes in order to make it uniform throughout. This can be done in small tanks, either by simply stirring with a stick or by a hand-operated paddle arrangement. A convenient method in those plants using compressed air for washing the filters is to have in the bottom of the tanks a series of perforated brass pipes through which air can be blown, thus thoroughly mixing the solution. Piping for handling the alum solution should be preferably lead or brass, as iron pipe is quickly corroded. Whatever kind of pipe is used, there should be inserted numerous unions and plugged tees and crosses to facilitate cleaning. If convenient, there should be a connection to a water pipe, as this makes possible the thorough flushing of the chemical lines whenever needed. Iron pipes are satisfactory for the soda ash solution.

Calcium Hypochlorite.—While treatment of the water with calcium hypochlorite is really not a part of the filtration process, its use in connection with rapid sand filters has become so general that the methods of handling it will be discussed at this point.

The chemical when fresh is a dry powder containing about 35 per cent. available chlorine. It is generally furnished in steel drums holding either about 350 or 700 pounds. After standing open for some time, the chemical takes up considerable water, and the per cent. of available chlorine decreases. For small parts it will be found economical to pay slightly more for the chemical and have it packed in smaller containers, say holding 100 pounds. The percentage of available chlorine in the powder should also be determined, as otherwise doses much less than intended are liable to be added. The test is not a difficult one, and if the reagents are made up by a chemist the plant attendant can carry out the determination. The preparation of the solutions and the methods of testing are described quite fully on page 72 of Water Supply Paper No. 315 of the United States Geological Survey, entitled "The Purification of Public Water Supplies." This pamphlet, which can be obtained without cost, will prove of value to all interested in the subject. Whether the powder is tested or not, the solution actually fed to the water should be, as this is the only way to know the actual rate of application.

Tanks for hypochlorite solutions should be made of concrete or iron. Concrete is the best, as it is not attacked by the solution. Wooden tanks are quickly destroyed by the action of the chemical, but if only wooden tanks are available they may be made satisfactory by being lined with a layer of cement mortar plastered over a layer of chicken wire netting or metal lathing which is nailed to the sides of the tank.

Lead piping should preferably be used for carrying the solution, but whatever pipe is used the same precautions against stoppages mentioned under alum tanks should be adopted.

The chemical is soluble in about twenty times its weight of water, but it is not advisable to use it in more than a 2 per cent. solution. For the plant treating elss than a million gallons per day it will be better to use a one or a one-half per cent. solution, as it is extremely difficult to regulate the small flow necessary with the stronger solution.

The solution tanks should be provided in duplicate, and each should be capable of holding enough solution to run about twelve hours. The following table will be found convenient in determining the size of solution tanks needed and the rate of feeding the solution:

Parts per million available chlorine	0.2	0.4	0.6	0.8	1.0
Pounds of hypochlorite per million gallons	5	10	15	20	25
Gallons of water to make a one per cent. solution ...	60	120	180	240	300
Gallons of one per cent solution to be fed per hour per million gallons per day	2.5	5.0	7.5	10.0	12.5

Suppose it is desired to treat 550,000 gallons of water per day at the rate of 0.4 part per million available chlorine using a one-half per cent. solution. From the table, opposite the required amount of chlorine, it is seen that 10 pounds of chemical and 120 gallons of water are required for a million gallons using a one per cent. solution. With a one-half per cent. solution 240 gallons of water would be required. Since it is wanted to treat 550,000 gallons, there would be required for one day 0.55 of 240 gallons, or 132 gallons of water, and 0.55 of 10 pounds, or 5.5 pounds of chemical. This would need to be fed at the rate of 5.5 gallons per hour, or a pint every minute and 22 seconds.

For the small plant the best method of making the solution is to mix up a paste of the chemical, using at least a half gallon of water for each pound of hypochlorite. This paste can then be put in the solution tank and diluted to the required quantity. The most important point to be observed is to get all the available chlorine dissolved. This requires that the solution be agitated for some time after mixing. If the mixing is thorough, there will be little active chlorine left in the sludge which settles in the bottom of the tank. It is advisable to have the draw-off pipe opening about four inches above the bottom of the tank, as in this way the clear solution can be drawn off without disturbing the sludge. This sludge should be flushed out at intervals to prevent its getting into the solution pipes and causing trouble by clogging the regulating orifice.

Amount of Chemicals to Be Added.—The necessary amount of sulphate of alumina to be added to a water depends on several different things. If a clear colorless water is being treated for the removal of bacteria, only enough chemical is needed to form a flock which will deposit on the filter and prevent the passage of the bacteria. As a general rule, 0.5 grain per gallon will suffice for this purpose. When a water is turbid, the amount needed will depend on the amount of turbidity. In a properly operated plant the turbidity is measured at least once a day, and the chemical dose regulated from this measurement. For turbidities under 100 the most simple arrangement for reading the turbidity is to have a series of standard clay turbidities prepared in pint bottles, a good series being turbidities of 10, 20, 30, 40, 50, 75 and 100. The standards should be prepared in accordance with the Standard Methods of Water Analyses mentioned heretofore. The writer is quite certain that, in those states where the state board of health has a laboratory, it would be more than willing to prepare standards of this kind without charge, unless for the materials, which would be very little. When the writer was in the employ of the New Jersey State Board of Health he had standards of this kind prepared and furnished to all the plants of the state that did not have a laboratory in connection therewith. In return, the daily records of turbidity and chemical added were reported once a month. Where the turbidity is over 100, the above standards can be used by diluting the water to be tested with clear water and taking account of this fact in figuring the turbidity. Unless this is done, a candle turbidimeter, as used by the U. S. Geological Survey, will be required. At one plant in New Jersey the man in charge made his own standards by filling bottles with the actual raw water at times of different turbidity. He found by experience the necessary amount of chemical for each turbidity and thereafter regulated the dose according to these standards. This is a satisfactory method, but its objection is that the results cannot be compared with other plants.

The following table from the American Civil Engineers' Pocket Book, page 928, will be found valuable in approximating the necessary amount of chemical.

Since conditions vary so much, it is probable that these quantities will not give just the right reaction in every case. For this reason a similar table should be prepared at every plant in accordance with actual conditions found. After this is done the chemical dose can be regulated from the turbidity readings.

What has been said with regard to turbidity applies equally well to those plants whose chief aim is to remove color. The color of water does not, as a rule, fluctuate as rapidly or as much as turbidity, but it is much harder to remove. Color standards similar to those described for turbidity are in use at several New Jersey plants. The removal of color generally requires more chemical than for turbidity and longer periods of coagulation. Unfortunately waters highly colored with organic matter are usually very low in alkalinity, many times even being of acid reaction due to humic acid from the swampy areas in which the water rise. A color of 10 can just be noticed in a glass of water on a white cloth, while a color of 25 or over is very striking. It is absolutely essential that a plant handling a water of this type be regulated in accordance with alkalinity and color determinations. Without such regulation there is great danger of having free alum in the filtered water; while if soda ash and alum are added in such uniform quantities as to never have this happen, the plant is not being economically operated. Besides this, larger doses of sulphate of alumina make the water corrosive, causing the unpleasant "red water" troubles in house piping. Because of this fact and because it is good business, the chemical dose should be kept as low as is consistent with proper color removal. This is only possible with careful operation based on the tests mentioned above.

In plants handling waters almost always turbid or colored, if sufficient chemical is used to effectively remove the turbidity or color, the bacteria removal will generally take care of itself. In other words, more chemical is needed to remove turbidity and color than to remove bacteria. In fact, a water slightly turbid is much easier to treat than a clear water, as the settling of the turbidity drags down with it the greater parts of the bacteria. This action has been taken advantage of at a few plants by adding to the [illegible] the coagulation [illegible] of clay and water, thus causing an artificial turbidity. This is particularly ap

Average Amounts of Sulphate of Alumina Necessary to Use for Different Turbidities and Color

Turbidity	Alum Grains per gallon	Alum Pounds per million gallons	Alkalinity necessary for reaction. Parts per million
0	0.50	72	5
50	1.00	143	9
100	1.35	193	12
200	1.78	254	16
300	2.05	293	18
500	2.50	357	22
700	2.87	413	25
1,000	3.32	474	30
1,500	3.39	557	34
2,000	4.40	628	38
Color.			
50	1.00	143	9
100	2.00	286	17
200	4.00	572	35

plicable in starting coagulation in a clear colored water.

The amount of hypochlorite necessary to properly disinfect the water will depend primarily on the amount of pollution therein. A clear ground or filtered water, but slightly polluted, will require only about 0.2 part of available chlorine per million. Most surface waters will require about twice this amount. A water that is very turbid may require as high as 1.0 part per million to effect good bacteria reduction. There is always danger of tastes and odors in a water treated with hypochlorite, and while these qualities are not detrimental to health they are very unpleasant. A water high in organic matter will often give tastes which are not due to the chemical itself but to its effect on the organic matter.

There is only one way to properly control the amount of hypochlorite needed, and this is by bacteriological tests. Where a laboratory for making these tests is not available, however, the test proposed by G. Sims Woodhead will be found a valuable aid. This test is as follows: Fill a quart bottle of clear white glass with the treated water and add to it a small crystal of potassium iodide, a few drops of weak acetic acid and a teaspoonful of starch solution. Shake well and hold bottle over a white paper. A blue tint indicates too much chlorine while a violet tint shows the correct amount. The starch solution is prepared by weighing out a small quantity of starch, mixing it to a paste with a little cold water and then adding this paste to two hundred times its weight of boiling water and allowing to boil a couple of minutes. A few drops of chloroform added to the bottle in which the solution is kept will preserve it. The writer knows of one plant treating about 30,000,000 gallons of water per day that uses the above test almost exclusively in determining the necessary amount of hypochlorite.

Place of Adding Chemicals.—There is more or less difference of opinion among authorities as to the best places to add the various chemicals. It has been the writer's experience that where soda ash is used it should be added before the sulphate of alumina a sufficient time to allow perfect mixing to take place. The two chemicals should never be added through the same pipe or at the same place, as is sometimes done at plants where the action of the chemicals is not understood. In a plant treating water with high turbidities, where the coagulation basin is so arranged that it can be divided, it will often be found advisable to divide the dose of sulphate of alumina, adding part of it where the water enters the second division after some of the turbidity has settled. The total amount of chemical needed will generally be lowered if the above plan is followed. Another method of operation which will sometimes reduce the amount of chemical needed can be used where the coagulation basin is large enough, this scheme being to overdose the water for a time with sulphate of alumina and then not add any for a while. It has been found to be very efficient and economical at Springfield, Mass., in connection with slow sand filters.

In a rapid sand filter there are three places where calcium hypochlorite can be added. These are in the raw water, the coagulated and settled water, and the filtered water. When added to the raw water, a large amount of chemical is required, but its regulation does not need to be overly accurate. It is undoubtedly less effective here than at the other two points, as in a well regulated plant the coagulation basins remove a considerable percentage of the bacteria without hypochlorite. When added to the settled water, less chemical is required, and its regulation does not need to be especially accurate, since the filters will remove most of the tastes and odors. Another advantage is that the load on the filters is lessened by adding at this point. In the writer's opinion, under most circumstances the best place to add the hypochlorite is to the filtered water. Much less chemical is required at this point than at the others, but the regulation must be more accurate in order to avoid underdosing, or overdosing with its resultant tastes and odors. The main advantage lies in the fact that the disinfecting action at this point is a factor of safety for all the previous operations.

Wherever the chemical be added, it is necessary that a period of contact be allowed for the disinfecting action to take place. This period varies with the character of the water. A clear, only slightly polluted, water requires only a small amount of chemical and a period of about an hour. A heavily polluted water requires a large amount of chemical and a contact period of only a few minutes.

Steel is not only displacing timber in railway carriage construction, but also in goods vehicles of various classes. In order to obtain rigidity and strength it is usual to ridge or corrugate the plates in various ways, but according to the Railway News a new method of construction is finding favour in some quarters, and particulars are available of a goods wagon in which the entire end is formed of a single sheet of steel pressed with concentric annular corrugations, no posts, braces, or rivets being required. The plate is attached to the car body by means of bolts or rivets engaging the corner angles, and it is claimed that the design releases additional space inside, adding about a foot to the length available.

The National Paving Brick Manufacturers' Association recently had an exhibit of paving. A slab of brick pavement taken from the streets of Columbus, Ohio, was shown, to prove vitrified block's permanency. This pavement had been laid nineteen years and the brick showed practically no wear whatever, despite heavy traffic conditions.

Small Sewage-Pumping Plants*

By S. A. Greeley and Langdon Pearse†

THE design and operation of small sewage-pumping stations is a subject upon which very little has been written. One reason, perhaps, is that the use of such stations is avoided as far as possible in the design of sewerage systems for the smaller towns and villages, even at the risk of flattening grades to a point where thorough scouring may not always occur at low flows. However, on small areas and frequently on large areas where conditions are imperative, pumping stations are built to lift the sewage into the outfall sewers or to works for treatment.

In the design of the small stations, there are several points to be considered. (1) Preparatory treatment by screens is required to protect the pumps. This is more important on small installations, particularly those where attendance is intermittent. Bar screens with net openings of ½ to ¾ in. are common. There should be ample provision for ready cleaning and accessibility. (2) There should be provision of storage in a suitable well or tank, in order that pumps of reasonable size may be used with intermittent pumping. Sometimes pumping installations may serve to dose treatment works. The design should provide bottom slopes steep enough to keep the sludge moving to the pumps. (3) There is the question of location and character of buildings. (4) The total cost for operating and maintenance capitalized and added to the construction cost will give a means for comparing the relative merits of different sources of power available.

For the small sewage-pumping station, where intermittent attendance is planned, the use of electrically-driven pumps would seem to be ideal. They are clean, self-contained, noiseless, and easily controlled by well developed devices for automatic starting and stopping. Attendance is thereby reduced to a minimum. The equipment is usually compact and may be installed in comparatively small space. The cost of pumping depends on the local energy rates and is clouded only by the necessity of pumping intermittently rather than continuously. This increases the peak load on pumps.

Electrically-driven direct-connected pumps operate efficiently and economically. The recognized features would seem to be (1) vertical motors with a suitable oil bearing to support the moving parts of the motor; (2) support of the moving shaft and runner of the pump on a ball or roller bearing (placed above high water), and (3) connection with the motor by a flexible coupling. Steady bearings are desirable on the shaft at frequent intervals, with provision for oiling and accessibility. It is highly desirable, with any type of sewage-pump installation that it be set in a dry well (so far as possible) so that none of the moving parts requiring lubrication will be exposed to the sewage. This may frequently contain grit, which is destructive to bearings. The necessity of keeping gritty water out of water seals and bearings has not always been recognized by designers, as operating men have found.

Gas engines have also been developed for this service, operating on natural gas or artificial gas from mains. But with a very few exceptions (notably a small pumping station in Newton, Mass., handling sewage of about 760 people, with two 3½-in. centri-

TABLE OF COST DATA AND STATISTICS OF SEWAGE PUMPING

Station	Type	Approximate water hp. capacity	Approximate water hp. output	Cost of construction per w.hp. capacity	Cost of operation per w.hp. output per yr. Labor	Fuel	Repairs, supplies, etc.	Total	Date of data
1. Pennypack Creek, Phila...	Producer gas	45.0	9.0	$450	$735	....	....	....	1913
2. Hegewisch, Chicago......	City gas	30.5	21.0	465	1890	$210	$323	$2423	1912
3. Alewife Brook, Boston...	Steam	50.0	7.7	....	828	210	95	1133	1912
4. Quincy, Mass.............	Steam	70.0	15.2	....	417	110	48	575	1912
5. Saratoga, N.Y............	Electric	31.8	....	170	....	....	....	....	1907
6. Hudson, Mass.............	Electric	8.0	....	450	....	....	....	....	1907
7. Newton, Mass.............	Electric	2.5	0.14	840	775	1020	1105	2900	1906
8. Plainfield, N.J.									
Monroe Ave..............	Air	....	0.25	....	....	760	....	....	1912
Randolph Road...........	Air	4.5	1.00	1040	....	586	....	....	1912

Note:—A water horsepower is figured from the rated capacity or actual output of water per day and the total life.

(1) Pennypack Creek Sewage Disposal Works, Philadelphia, Penn. Present average quantity pumped, 1,000,000 gal. per 24 hours, against 50-ft. head. The equipment consists of one 2,000,000-gal. and one 3,000,000-gal. vertical submerged centrifugal pump, geared to gas engines; and one 150-h.p. gas producer operated with anthracite coal.

(2) Hegewisch Sewage Pumping Station, Chicago, Ill.—Built in 1909. Present average quantity pumped, 1,500,000 gal. per 24 hours, against 10-ft. head. Two 10,000,000-gal. centrifugal pumps, and two 40-h.p. gas engines using city illuminating gas.

(3) Alewife Brook Pumping Station, Metropolitan Sewage Works, Boston, Mass. Present average quantity pumped, 3,500,000 gal. per 24 hours, against 13-ft. lift. Two 4,500,000-gal. vertical centrifugal pumps, and one 13,000,000-gal horizontal centrifugal pump; all operated by compound steam engines.

(4) Quincy Sewage Pumping Station, Metropolitan Sewage Works, Boston, Mass. Present average quantity pumped, 4,000,000 gal. per 24 hours against 22-ft. lift. Three centrifugal pumps of 3,000,000, 5,000,000 and 10,000,000 gal capacity, operated by compound condensing engines.

(5) Saratoga Springs, N.Y. Daily pumpage varies from 1,500,000 to 3,000,000 gal. per 24 hours against 30-ft. lift Three vertical submerged centrifugal pumps with capacities of 1,500 gal per min. each, and three 20-h.p. induction motors.

(6) Hudson, Mass. Two vertical centrifugal pumps, each with a capacity of 500 gal. per min. against a total head of 35 ft. Each pump is operated by a 15-h.p. induction motor.

(7) Newton, Mass. The average daily quantity pumped in 1906 was 25,565 gal. against 30-ft lift. Two 3½-in vertical submerged centrifugal pumps geared to 5-h.p. vertical gasoline engines.

(8) Plainfield, N.J. Randolph Road Pumping Station. Present average quantity pumped, [illegible] gal. per 24 hours against 40-ft. lift. Two 10 x 6-in. compressors; two 7.5 h.p. electric motors, one gasoline engine for reserve, one 3½ x 8 ft. air receiver, and two duplex displacement ejectors. The plant capacity is approximately 500 gal. per min

Monroe Ave. Pumping Station. Present average quantity pumped, approximately 30,000 gal. per 24 hours against 10-ft lift. Two air compressors, two [illegible]-h.p. electric motors and two 150-gal. ejectors. The plant capacity is approximately 300 gal. per min.

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*Abstract of a paper read at the annual meeting of the Illinois Society of Engineers and Surveyors.

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fugal pumps, the developments have been mostly in the larger stations such as the East Side plant at Columbus, Ohio, where two 60-h.p. gas engines operate two 10-in. centrifugal pumps, chain-belt driven. At Hegewisch, in Chicago, the pumps are run by gas engines fed from the city mains. The latter installation is belt-driven and pumps the entire sewage, as well as a large proportion of the storm flow. The Columbus station handles only the dry-weather flow and a very small proportion of the storm sewage. The Newton station is semi-automatic, being started two or three times a day by a fireman from the neighboring waterworks pumping station. A stopping device is installed.

The use of producer gas for the purpose of sewage pumping, as well as waterworks pumping, appears attractive, but has not been used to any great extent for small installations, since the attention of the promoters of producer gas has been directed largely to industrial installations, and the municipal field has been left untouched. There is, however, a station operating at Pennypack Creek in Philadelphia.

Gasoline and kerosene for sewage pumping are, of course, available, but with the present price of gasoline, the cost is high. Kerosene is less expensive, but seldom used. However, engines working on distillate, common in California, should prove as successful for sewage pumping as they have for irrigation. Madison (Wis.) pumps all the dry-weather flow with engines converted to run on kerosene.

Sewage installations, however, require to be operated intermittently, as a rule, and therefore need automatic control where attendants are lacking. This favors the direct-connected, compact, electrical units. The gas engine and other types of explosion engine require somewhat more attention and care in order to secure successful operation. For the sewage-pumping station in the small town, steam-driven machinery is generally out of the question, as the efficiency here is low and the cost of attendance high. It is only when the installations are operated in connection with other works that steam appears to be attractive for small stations, working on low lifts and handling amounts of sewage under 1,000,000 gal. per day.

Some interesting data on the cost of small plants are given in the accompanying table, showing the cost calculated to water horse-power, regardless of the efficiency produced. We have also tabulated the costs of operation as taken from the various records in print. These costs of operation are given with the reservation that if used they should be carefully studied from the standpoint of actual application to a case in hand, as there is a tendency in many municipal records as given out to make as good a showing as possible by giving only the charges apparently chargeable to the pumping account and carrying other incidentals where necessary in other ways. Notes giving various particulars of the sewage pumping plants listed in the table are appended to the table.

A Practical Discussion of Waterproofing Problems

By Louis G. Mauer

THE problem that interests most of us is how to obtain most satisfactory results in waterproofing at a minimum cost. There are two classes of waterproofing—one underground, the other above. Underground work, as a rule, is subjected to water pressure either by seepages, springs or direct pressure where basements are below tide or streams. Work of this character requires an entirely different method of treatment than waterproofing the building above ground, since it must effectually resist a constant water pressure. Walls above ground are not subjected to constant water pressure, therefore they require a treatment to be water repellant: that is to say, a remedy to prevent the absorption of water.

Enumeration of Methods

There are four distinct methods employed to accomplish waterproofing results:

First. By density of the materials from which your walls are constructed; density of the material itself or the aggregates of which it is composed.

Second. By the membrane system. This method is used principally for underground work. For floors it is placed between concrete slabs, or on the outside of walls where the water pressure is against the wall.

Third. By a surface coating composed of asphaltum, tar, or any oil base material. The latter being water repellant, fairly good results are obtained. A surface coating is only efficient, however, as long as the material applied remains intact.

Fourth. By non-absorption or the elimination of capillary attraction. The material I have found to accomplish this result is a chemical solution having a water base, and which can be readily mixed in the cement aggregates for either underground work or surface application above ground.

In regard to the first method—Density—you are probably all aware that the aggregates of a concrete mass or cement mixture may be proportioned in such a manner as to obtain a density that will not permit the perculation of water, but to obtain this result in a concrete wall or plaster surface after they have hardened would incur a task that would not be practical for ordinary construction, nor could this method be judiciously applied to a brick wall which is always more or less porous and absorptive.

The Membrane System

The second method, the membrane system, is one that is very successfully used. To adopt this method for floor work it is necessary to place a concrete slab, then the membrane system, composed of asphaltum and felt, in such number of layers as deemed necessary, then the additional slab of concrete. The upper slab necessarily must be of sufficient strength to withstand the hydrostatic pressure. The actual cost of this method is the felt and asphaltum membrane, plus the cost of the lower slab of concrete. The membrane being composed of an absolute foreign material to the concrete does not become a component part of either slab or concrete—in fact, separates them entirely, the only bond between the two slabs being the cohesion of the asphalt itself.

Although it is claimed that the membrane system of waterproofing is to a certain extent elastic, still, it is frequently found that breaks occur when the concrete slabs develop contraction cracks, thereby impairing the results of waterproofing efficiency.

The membrane system is also used on the exterior of walls. This requires the necessary excavation to give room for applying the membrane. The cost of this work is the membrane plus the cost of excavation and back-filling of same, and in many cases a protection wall. If for any reason a membrane system could not be applied on the outside, and same would be adopted on inside of wall, it would be necessary to construct a special wall; otherwise, if the water should percolate through the outer walls, it would press away the membrane. The cost of this work for inside walls would be the cost of membrane plus the cost of wall to hold the membrane in place.

If, for any reason, breaks should occur in the membrane system, permitting water to penetrate the membrane, it would not necessarily mean that the break is where it shows on the surface, as the water may travel some distance between the membrane and the upper layer of concrete before finding the weakest point to the surface.

Surface Coating

The third method—surface coating—is used quite extensively for treating walls above ground, and to a certain extent for underground work as well.

By applying a good surface coating of asphaltum, tar or any oil-base material where the water pressure presses the coating against the wall, good results will be obtained so long as the life of the asphaltum or oil is retained in the coating. As a rule the oils are quickly absorbed when applied to any absorptive surface, leaving the solids of the coating as a more or less inert substance with its binder, in fact, its principal element of life, separated. To avoid this it is very important to have a foundation that will prevent the separation of oils and solids contained in the surface coating.

To apply a surface coating on the inside of walls under plastering, the so-termed damp-proofing or plaster-bond coat is, in my opinion, an absolute waste of the expense incurred. This applies to all material without exception. Whenever a wall is thoroughly saturated with water from the outside up to the point of the damp-proofing coat, there is no material, be it ever so elastic, solid or efficient, that will withstand the pressure. As a matter of fact it must then withstand a direct water pressure instead of being only a water repellant at intermittent intervals.

The fourth method—non-absorption—means the elimination of capillary attraction. Under this method and by using the materials referred to I have accomplished results on those problems that have come under my direct supervision, both underground where subjected to severe water pressure, and in treating buildings above ground by surface application. This material is a chemical solution (water base contains no oils), penetrates an absorbent substance and becomes a part thereof, accomplishing the waterproof results, not by the filling of voids or a surface coating, but by making the substance to which applied non-absorptive and impervious to water.

If you will carefully analyze the fact, you will find that even a very porous material containing a large percentage of voids will not become saturated with water unless it is absorptive, nor will you find that water will follow fine cracks in any surface, unless the substance itself has suction and absorb water. Now, then, this being a fact, the method of waterproofing by having the aggregate of the material made non-absorptive to resist water pressure and eliminate capillary attraction, for all surfaces exposed to water absorption at intermittent intervals, is one that will solve many of your difficulties.

Underground Work

Let us first consider its application for work below ground. In basements we accomplish results by the most direct and simple means. The plastering of the walls on the inside with waterproof mortar and the floors with waterproofed mortar topping, thereby saving the expense of exterior excavation and cribbing which would be necessary in order to apply a membrane or surface coating to the outside is good practice.

On new work where walls are green and bonding of plaster certain, no greater expense is involved than the nominal cost of the waterproofing material, which is to be added to the sand and cement for plastering and topping.

But in old basements or any surface not permitting a perfect bond, quite a different problem presents itself. Here the surface to be plastered must be carefully prepared to insure proper bonding of plaster by roughening the surface. We all know the weakest point is the angle between the floor and wall, therefore particular care must be taken to reinforce this point by forming a cove so as to make the connection between the floor topping and wall plaster continuous.

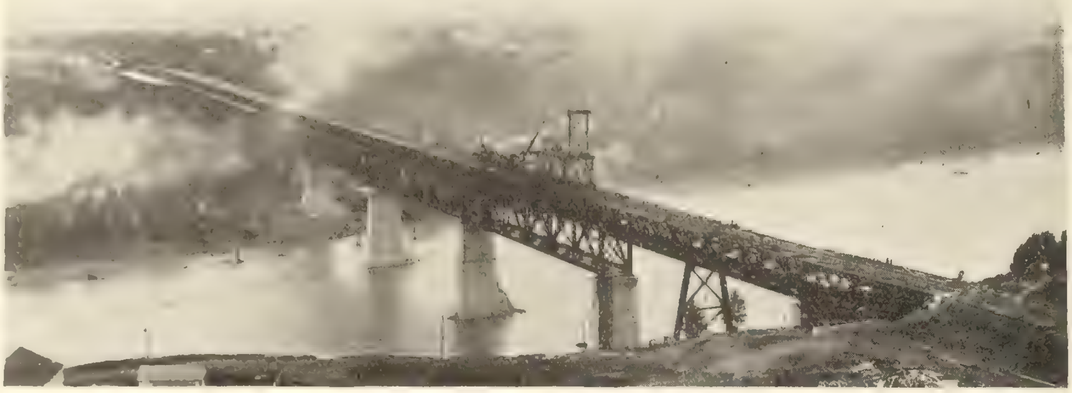
Should the argument be advanced that floors or walls waterproofed are liable to crack, thereby causing leaks, let me say that the chances are very slight indeed, if the walls are properly designed and constructed and the floors thick enough to resist the hydrostatic pressure.

Walls and floors that crack due to contraction or expansion or other causes will sever or open up a membrane almost as quickly as a plaster coating. And what is the result? A heavy expense is incurred, owing to the fact that the break in the membrane may be many feet away from the point where the leakage shows on the surface. With the membrane method repairs are virtually impossible, while a waterproof plaster coating may be quickly and permanently repaired at very small expense. The leakage always exists where it shows on the surface. The cracks could easily be cut out to a certain depth and pointed up, making same absolutely water tight.

Many basements presenting all sorts of conditions from seepage of ground water to tide pressure have been successfully waterproofed with this method. I would not hesitate to undertake to make absolutely dry any basement under the most severe water pressure by plastering it on the inside and using this material as a part of the water gauging the cement and sand mortar. This mortar can be applied even while the water is percolating through the wall.

If necessary the mortar could be held in place with boards pressed against the wall. This might develop small holes, permitting the water to escape, but which could easily be plastered up after the other portions are thoroughly set. Cement mortar applied on walls saturated with water will gradually dry out even with the water pressure against the wall.

No doubt this question will come to your mind will the use of this material, used in the aggregates



C.P.R. high level bridge, Edmonton, Alta.

cement mortars, be detrimental to its strength or cause additional labor in its use? In answer to this, I wish to state that on the contrary the use of this material is a decided advantage; the initial set is somewhat retarded, but in thirty-six or forty hours you will find the cement mortar much harder and stronger, this in comparison with equally proportioned cement mortar gauged with water alone. The working of cement mortar is also made much easier and smoother, the action being similar to that obtained by the use of lime putty in cement mortar.

Surface Application Above Ground

For treating a building above ground, the result can be obtained by a thorough surface application, by either brush or spray, preferably the latter. By this I mean every particle of the wall must be saturated. This will leave no surface coating and will not change the color or texture of any surface to which applied, be it a white sand or a lime stone or a red brick. A surface application will only give results and become effective when applied on any absorptive material.

Take, for instance, a porous brick. It requires very little effort to obtain penetration with this material of ¼ in. or even ½ in., and to this depth waterproof results would be found, permitting you to remove a part of the surface and texture of the brick, without destroying the waterproofing efficiency.

The method employed for treating walls that require a change of color is this: Waterproof as above mentioned, then apply any concrete paint for color effect only. By treating the walls with this material you have the most perfect foundation for any oil base material. The surface made non-absorptive prevents the absorption of the oils in your paint pigments. This, as you all know, is the life of any oil paint.

At this time I wish to caution you to guard against careless workmanship by the individual mechanic, the economical use of the material contrary to directions and requirements, and the lack of knowledge of these special problems by those in charge of the work.

Many big buildings in Berlin are built entirely of brick, and sandstone is used for outside walls and trimmings. In the Reichstag building in Berlin 32,000,000 brick were used, while in the new Dome church also in Berlin, over 25,000,000 brick were used. Other large brick buildings are the Anhalt depot and the City Hall.

The C.P.R. High Level Bridge at Edmonton

DURING the past year the Canadian Pacific Railway completed the erection of the bridge across the North Saskatchewan River to give them entrance into the city of Edmonton. The structure has a total length of 1761 feet and is 125 feet above the high water level of the river. On the upper deck are two street railway tracks and the track of the C. P. R. Calgary Branch, and on the lower deck is a 23-foot roadway with 8-foot sidewalks on either side. The south end of the bridge is a viaduct, with nine towers. The north end has one tower with two plate girder spans. The central portion is five deck trusses of varying spans. The main spans are three deck Pratt trusses, two with spans of 291 ft. 10½ ins., and one with a span of 293 ft. 3 ins., and all are 48 feet deep. The two shore spans are deck Pratt trusses with 130-foot span, 19 feet deep. The viaduct at the south end consists of six bents of 96-foot deck trusses and 48-foot towers, the trusses being 18 feet deep, and two bents of 60-foot deck girders with 30-foot towers. The main channel piers are 140 feet high and 25 feet wide. The bridge allows the railway entrance into the city proper. A part of the line in the city required a 20-foot cut, with street cross-overs. At two points there have been erected reinforced concrete bridges to carry streets over the cut. These bridges are of the beam and girder type, with small columns, and cantilevered sidewalks. On the south side of the river there has been erected a reinforced concrete retaining wall tunnel, carrying two intersecting streets. The tunnel is 206 feet long, with a retaining wall 35 feet high, and has a 24-inch solid slab from wall to wall to carry the streets. The two walls are 18 feet, face to face, and are in alignment with the six degree curve at this point. The design of the high-level bridge was made in the office of the C. P. R. Bridge Engineer, at Montreal.

More than twenty concrete piers built several years ago, and submerged in the United States Navy Yard at Boston, are again being examined to note the action, both mechanical, due to frost, and chemical, due to ingredients in the sea water. As this subject is one which has a large bearing on the permanence of piers, abutments, sea walls, etc., when built of concrete, these experimental tests are expected to yield some very valuable results.

Materials and Methods in Producing Satisfactory Road Carpets

By Major W. W. Crosby*

BEFORE the advent of the motor vehicle the maintenance of water-bound macadam roads was easily and satisfactorily accomplished by simple methods at a cost of from $50 to $250 per annum, and when properly maintained such roads were easily constructed, agreeable to their users and abutters, and advantageous from every point of view. Then, as motors began running over these roads, an early notice given of their effect was the rise and offensive distribution of dust. Comment expressed the idea that the road metal was fast being removed from the road, and distributed in finely divided condition over the adjoining property. Shortly afterward the loosening of the road metal appeared, and, when sufficiently loosened to so permit, it was found frequently to have been piled in windows along the sides or edges of the road crust, leaving pot-holes or ruts in its former location.

The necessity for preventives against the dust, the loosening of the road metal and its dislodgement was quickly apparent, and experimentation began. Water sprinkled on the dust temporarily prevented its distribution, but its effects were not lasting, and, aside from the expense and inconvenience of sprinkling as often as found to be necessary for satisfactory results, certain disagreeable concomitants seemed unavoidable. Excess in application was an apparent necessity, and the resulting mud was in many cases seriously objectionable. The effort was then made to reduce the mud nuisance to a minimum, and at the same time to prolong the effects of sprinkling, by the addition of hygroscopic salts, such as calcium chloride, to the water. In many cases improvement resulted, but it was found that with motor traffic beyond a certain amount, even this treatment did not prevent the loosening and dislodgement of the road metal.

At the same period, oily liquids were tried in place of water, probably with the idea that they would so weight and otherwise affect the dust as to prevent its distribution, and at the same time be longer in evaporating from the road. In some cases the results of oiling were disastrous. The dust, it is true, was prevented from forming clouds and being blown about by every passing breeze, but in place of this there was formed on the road a greasy mixture which was thrown up on to goods by horses or the wheels, or tracked by the feet of persons into dwellings. It spotted everything it touched, and it seemed in many cases that "the last state" of that road "was worse than the first." Further, it soon appeared that where motor travel was at all heavy this oiling had not been effective against pot-holing or rutting.

In other cases the oiling had been attended with most satisfactory results. The dust was suppressed, the road metal prevented from loosening, and the pot-holing and rutting consequently avoided. It even seemed that the road surface had really been improved in some ways. It was smoother (perhaps, in a few cases, injuriously so under certain weather conditions), less noisy, less glaring in unshaded spots on bright days, and more resilient, apparently, to horses' feet. But further, and what to many appeared to be the most important result, it seemed that, coincidentally with the other good results, the wear on the metal forming the road crust had been reduced materially or even obliterated by the formation over it of a carpet composed of the adhesive portions of the oil (or tar) and the sand, stone chips, or fine material such as the dust, found or spread on the road surface. This carpet took the wear and thus protected the road metal. As long as the carpet remained intact no surface wear of the stones composing the macadam was possible, and little or no dust was formed from the carpet itself that could not be absorbed or held by it for a considerable period. Further, the presence of an appreciable carpet prevented the loosening of the stones of the road crust if it did not actually increase their bond, and thus the resistance to pot-holing and rutting was increased materially.

The advantages of a proper carpet were readily apparent, and a way out for the localities in the peculiar situation first referred to was opened. Previous to its discovery they had faced the prospect of being obliged to meet great increases in their annual expenditures for maintenance with the almost certain knowledge that when the motor travel should have increased beyond a certain figure there would be nothing left for them to do but to reconstruct their roads, probably with paving at a high cost, or they had to face such immediate reconstruction if the increase in maintenance charges seemed sufficiently imminent and formidable.

Limits of Carpeting System

With the possibilities held out by "carpeting" the roads came, of course, the questions of what the limits of such treatment were then, of the possibility of their extension, of the proper methods and materials for success within such limits, the causes of failures or dissatisfaction where such had occurred in practice with carpets, etc., etc.

It was soon proved that there were limits to the successful adoption of carpeting methods for the improvement of macadam roads, or for adapting the latter to withstand otherwise destructive travel. If, as the name implies, a "carpet" is an appreciable thickness of cementitious material mixed with a mineral or other aggregate, it naturally follows that there may be travel conditions just too severe for support without damage by ordinary macadam and yet not severe enough to warrant the construction of a "carpet" on the surface of the latter. In such cases the simple treatment occasionally, say, annually, of the macadam with a proper oil, tar or pitch compound has proved entirely satisfactory and economical. In such cases no appreciable thickness of carpet is formed on the macadam, and the stones of the latter still continue to take the wear though they do not then loosen and become displaced as they would without the pitch application. Of course, in these cases a carpet could be used, but until the amount of travel justifies its use, it often would be unnecessary and not economical under the local conditions.

On the other hand, if we differentiate between a mixture of pitch and grit made "in situ" and a, perhaps and a mixture made previous to placing on the road surface and then spread and rolled into place, by referring to the latter as a "sheet pavement" and limiting the application of carpets to roads carrying heavy travel. For instance, if the travel comprises a very large number of hard-tired vehicles carrying extremely heavy loads, it has been found that a carpet will not prove economical though a sheet pavement may. The trouble seems to be that the particles composing the carpet are not of sufficient mass to resist disintegration under such stresses, nor to be able to resist lateral displacement before or after fracture under such loads, or that the proportions of the different sizes of particles forming the aggregate are not right.

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Again, it is found that if the proportion of horse-drawn to motor vehicles is too large, a carpet is in danger of destruction from being perforated or picked to pieces by the caulks of the horses' shoes. Perforations allow water to penetrate and to weaken the bond to the macadam, and continual picking at the carpet by the caulks breaks it to pieces unless the rolling and compressing action of motor and other wheels is sufficient to off-set both.

The determination of the exact limits, in terms of travel units, to the successful use of carpets is not yet established. It is affected by climatic and other local conditions, by the character of the pitch employed, by economic factors, etc., and because of the importance of the economic factors and the comparative newness of the problem, even the approximate determination must be deferred for the present.

The possibilities of extending these limits when once approximately determined will naturally be clearer then; and such possibilities may be increased, of course, by the improvement of materials and methods now being developed.

Materials and Methods

The question of the proper materials and methods to be used in order that successful carpets may be had within reasonable limits for such work are many and varied, and in so many cases the decision is so largely affected by local considerations that generalization is difficult. However, it may be said that the writer's experience with many hundred year-miles of this work leads him to state as follows:

(1) A 12-ft., water-bound, limestone macadam will not successfully support travel aggregating 400 units per average day of ten hours, and where 60 per cent. of the total travel is that of motors.

(2) Such a road surface can be made to sustain such travel with physical satisfaction by a carpet made with proper pitch.

(3) An 18-ft. water-bound, trap-rock macadam is incapable of sustaining, without serious deterioration in a few months, travel aggregating 2,500 units per average day of ten hours, and where 90 per cent. of the total travel is that of motors.

(4) The surface treatment of such a road surface with a proper cut-back asphalt or a proper compound of tar will enable it to sustain such travel with physical satisfaction.

(5) The use of sand on top of the pitch is open to grave objections, and the value of its use before spreading the pitch is questionable, clean stone chips of small gravel, free from particles that will not pass a ⅛-in. mesh, being preferable.

(6) With the use of a proper pitch, no material advantage is had by closing the finished carpet to travel for a period after its construction, provided the adhesion of tires to the surface is prevented by watering, spreading an excess of grit, or other means.

(7) The construction of a carpet on a macadam adds immaterially to the supporting power of such macadam, except as it may increase its ability to protect the foundation by shedding water.

(8) The successful thickness of a carpet is that but slightly in excess of the height of the larger sized particles of the grit used, and the maximum successful thickness is not over 1 in., but generally nearer ½ in.

(9) Better results are secured from applications of the pitch hot and under pressure than from cold gravity applications.

(10) Where the quantity of pitch to be applied is to exceed one-third of a gallon per square yard, better results will be obtained by making two or more applications of it.

(11) For pitch carpets, a pitch compound, to be satisfactory, should show at least the following characteristics:—

(a) It should flow freely, though not excessively so, under the conditions of applications.

(b) It should show, after evaporation at 105 deg. Cent. for twenty-one hours (20 grammes in 3½-in. dish) a percentage of residue neither above nor below certain limits, dependent upon local conditions, and this residue should show a penetration of not less than 10 at 4 deg. Cent., nor more than 200 at 25 deg. Cent. (No. 2 needle, 100 grammes 5 sec.)

(c) The naphtha soluble portions of the residue above mentioned should, when evaporated on glass, show themselves to be decidedly adhesive.

(d) The amount of "free carbon" present in tar compounds should be less than a maximum percentage of the fraction distilling between 225 deg. and 300 deg. Cent., the figure for this maximum being dependent upon local conditions.

(12) The best grit for carpets is clean stone chips or pea gravel, free from more than 20 per cent. of fine materials, that will pass a ⅛-in. screen.

(13) For the sake of uniformity in spreading, the mechanical application of the grit is preferable to manual application, even at the expense of some waste of material.

Failures frequently teach more than successes. And under their consideration may perhaps be most impressively discussed their causes.

(14) A poor foundation frequently explains the failure of any pavement or road crust. The best carpet can do no more to remedy a poor foundation than by aiding to prevent water reaching the latter.

(15) Complaints of excessive slipperiness on carpeted roads are often heard, and these are most frequent perhaps where old macadam roads have been so treated. With the smoother surface of the carpet, less crown than ordinarily supplied on a macadam is necessary or desirable for drainage purposes. But as the carpets were applied to these old roads, in many cases without the reshaping of the macadam, the completed work has excessive crown. This is conducive to sideslip—the thing objected to. Where the cross-section is planned for the presence of a carpet and the proper crown so provided, carpeted roads are not objectionably slippery unless a pitch is used which becomes too hard at low temperatures. (See 11b).

(16) A carpet will not prove satisfactory that varies greatly from a uniform thickness or composition. If potholes and ruts exist in the old road it is useless to attempt to remedy them by simply carpeting the

surface. The necessary repairs must first be made and its carpet applied, the results being directly proportionate to the surface condition of the road carpeted.

(17) A carpet must have appreciable thickness, and, within limits, the greater the travel the thicker the carpet needed. Successful carpets, even with light travel, can seldom be made with less than ¼ gallon pitch per square yard.

(18) A pitch compound which does not "set up" or harden rapidly and sufficiently to a certain degree (see 11b), will not produce a satisfactory carpet, nor will a pitch that is too greasy in character. The former will be objectionable, as were certain oil treatments referred to, and the greasy pitch will produce a carpet that will shift about under traffic, add to the effort required for hauling over it, and probably emulsify in wet weather into intensely disagreeable mud. A layer of this mud on the surface of even good macadam road frequently seems to be the cause of the whole road "going to pieces," or of its "bottom dropping out" during an open winter.

(19) "Cut-back" pitches, far from being objectionable when properly compounded, are frequently most desirable for carpeting work, but their composition should be most carefully limited. Many failures have been due to the use of compounds improperly made by the addition of the wrong light fractions to poor or even good, hard pitches.

(20) One of the most frequent causes of failure of carpets comes from lack of proper adhesiveness on the part of pitch compound. A greasy pitch compound is seldom sufficiently adhesive, nor is one which fails to pass the setting-up test. Unless the adhesion of the carpet to the base is good, the carpet will be worn loose, and then easily destroyed, as the body by itself is light.

(21) The cohesiveness of the carpet body depends, of course, largely on the adhesiveness of the pitch compound. But the adhesion may be practically destroyed (and the cohesion of the carpet body also) by the use of the pitch compound on a dirty or dusty surface, or with materials containing too great a proportion of fine material. The presence of moisture may with some pitch compounds also produce a similar effect. Ordinarily, however, the presence of a moderate amount of moisture has not nearly so bad an effect as the presence of a small amount of fine stone dust ("flour"), or similar material. Indeed, with some materials drenching the road surface with water previous to applying the pitch compound is reported to be advantageous. Many failures in carpeting have been traceable to the use of the old worn-out dust from the road surface in place of suitable clean, fresh grit.

(22) Some apparent failures with carpets have been so classified simply because of impatience on the part of those in charge of the work. It frequently happens that a first attempt does not produce the result desired or anticipated, and a failure is recorded when a second attempt would have produced entire satisfaction. New carpets sometimes seem to scale or flake badly from the old road surface. Proper patching followed (where a properly laid foundation was then made) by a second coat frequently results in a more satisfactory surface.

The successful use of carpets for the protection or improvement of macadam roads has been so great that its development for other situations has followed. The noises of brick pavements, and of wood and stone block pavements, and many of the inherent defects of concrete as a pavement, have often been reduced or cured by the use of a proper carpet, and the satisfaction with, or advisability of, each of the surfaces mentioned thus greatly increased, to say nothing of any economy in the use of the carpet by the resulting prolongation of life in the more expensive pavement. From the experience of the writer, he believes that, especially in cases where considerable well-built water-bound macadam exists, but now needs protection from motor traffic, the system of carpeting such roads or streets is most worthy of deep consideration, and that those authorities such as the British Road Board, who apparently have carefully and earnestly applied themselves to this subject, have acted wisely.

Economic Design of Standpipes and Conduits

The economic design of standpipes and conduits for water-supply purposes was presented mathematically by H. E. Babbitt (instructor in Municipal and Sanitary Engineering, University of Illinois, Urbana, Ill.) at the annual convention of the Illinois Water Supply Association. For standpipes a total of sixteen factors were considered, including not only the dimensions of the pipe, the thickness and weight of the steel plates, the foundation, costs of materials, labor, etc., but also the cost of pumping water 1 ft. high, and the capital charges on the extra initial cost of the pipe to decrease the pumping cost. Assuming that the standpipe is to be used for storage between pumping and that it is to be filled and emptied once each day, "the most inexpensive standpipe which can be constructed, whether of 1,000 gal. or 1,000,000 gal. capacity, should have a height of 23 ft., if the cost of pumping is not considered," and 15 ft. if it is considered. Changes in the values of one of the 16 factors may materially change the economic height. Thus, if steel be taken at 2c. per lb. instead of 5c. the height should be 36 ft. instead of 23 ft., if pumping costs are ignored, or 17 ft. instead of 15 ft. if pumping is considered.

The studies for the economic design of conduits were based on the following assumption:

> In the construction of a large gravity water conduit of considerable length passing through several classes of material, and with a limited total loss of head, it is less expensive to allow a relatively steep grade to the more costly portion and a relatively flat grade to the less costly portions, than if the entire conduit were laid at the same grade with the same sections through all classes of materials. It is thus evident that there is some relation between the grades for each section which will give the minimum cost for the entire conduit.

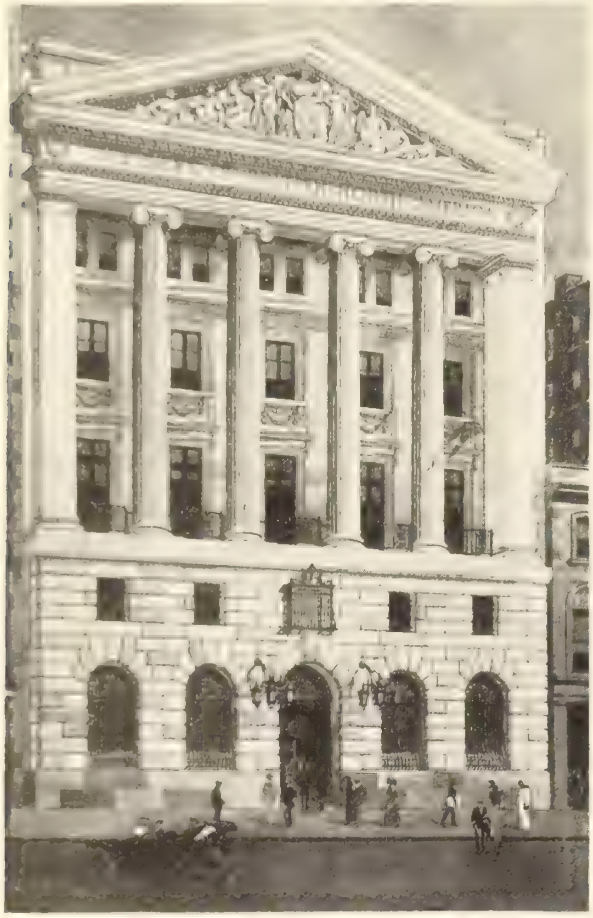
Examples are worked out for different classes of materials, slopes and diameters. In the discussion reference is made to the proposition of Wiggin advanced in "The Catskill Water Supply of New York, by Lazarus White," as proving graphically that "if a series of parallel tangents be drawn to the cost curves such that the sum of the ordinates of the points of tangency is equal to the total permissible head, the least cost of the entire conduit will be obtained by constructing each section of conduit with the loss of head indicated.

A steel bridge 1¼ miles in length and consisting mainly of forty 150-ft. spans has just been completed by the Bengal & North-western Railway across the Jumna River at Allahabad, India.

The B. B. N. A., Montreal

WITHIN the past three or four years, Montreal has added several very fine banking offices in the business district, particularly in St. James Street. The Bank of British North America is the latest institution to rebuild, and Norcross Bros., Montreal, have just completed a magnificent structure on St. James Street, from designs by Barott, Blackader and Webster, Montreal.

The building has a frontage of 70 ft. 7 ins., with a depth of 100 feet, and a height of 90 feet to the top of the pediment. There is a sub-basement, basement, and five floors. The exterior is constructed of Stanstead granite, a feature being the number of columns also built of granite. The walls are of terra cotta.


The Bank of British North America's new building at Montreal.

The sub-basement is devoted to the book vaults and the boiler room; while the basement contains the safety deposits and the security vaults, with provision for housing the dynamos. The ground floor is the principal room; here are situated the banking offices, the public space being 40 x 34 feet. The height of the room is 29 feet; the ceiling is 29 feet high, and is decorated in blue and gold. The manager's room, writing room, and committee room are built on the front portion of the ground floor and are reached immediately from the vestibule. At the rear of the tellers' and other banking spaces is the clerks' working department.

Above the ground floor is the mezzanine floor, containing the inspectors' rooms; on the first floor is the general manager's department; while on the fourth floor there is accommodation for the clerical staff, kitchen, dining room, and three bedrooms. The first floor and general manager's offices are furnished in mahogany and the other portions of the building in oak. A large amount of wrought iron is used, notably the lamps over the main entrance in St. James Street. The grilles in the banking department on the first floor are of bronze.

There are two elevators, one for public use on the left-hand side of the main floor and the other for service at the rear of the working department on the same level. The lighting is by electricity. The cost is about $500,000.

Mechanical Filtration

A PAPER on the above subject was read at a recent meeting of the Manchester Association of Engineers (Eng.). The author devoted the major portion of his paper to a description of a typical installation of mechanical pressure filters for dealing with moorland water, namely, that belonging to the Ashton-under-Lyme, Stalybridge, and Dukinfield Water Board. He said that the advantages of pressure filters over sand filters included the following:—(1) The initial outlay was only about one-third of slow sand filters; (2) all discoloration could be removed by the addition of a coagulent; slow sand filters would quickly choke up under similar conditions and soon became inoperative; (3) pressure filters being enclosed no trouble need arise from the growth of algae nor from frost; (4) pressure filters occupied about one-fiftieth of the space required by slow sand filters; (5) the loss of head was negligible, being about 2 lb. when pressure filters were clean and 5 lb. to 6 lb. just before washing, whereas the head was lost entirely with sand filters.

With regard to the cost of working pressure filters as compared with slow sand filters, the author said that it was difficult to make a comparison because the conditions were so variable, but he quoted from a paper read by Mr. Ross, analyst to the Burnley Corporation, in which the latter stated that with pressure filters—including coagulents for removing colour—the cost worked out at 22s. 10½d. per million gallons, as compared with 33s. 3d. for slow sand filters. According to figures given by Mr. Dixon, engineer to the Ashton, Stalybridge, and Dukinfield Water Board, the average cost of treating four different kinds of water by means of pressure filters and chemical treatment worked out at 9s. 5d. for treatment and 14s. 4d. for capital expenditure, giving a total of 23s. 9d. per million gallons of water. In the foregoing figures the life of the pressure filters had been based on twenty to thirty years, as against forty to sixty years for slow sand filters.

The author concluded his paper with a reference to the use of pressure filters for industrial purposes to enable the dirtiest river water to be made clear and bright and suitable for every purpose, providing the hardness was not objectionable. For this purpose the same filter as previously described is used, with some form of chemical treatment. Each filter, 8 ft. diameter, would deal with from 5,000 to 10,000 gallons per hour.

The sun power plant, at Cairo, Egypt (described in the February 25 issue of the Contract Record), was the subject of an interesting paper read before the Manchester (Eng.) Association of Engineers last month by the inventor, Mr. Frank Shuman, of Tacony, Pa.

Increased Activity at Vancouver, B.C.

An Optimistic Outlook for the Constructional Interests—Progress Reports on the New Hotel Vancouver and other Large Buildings

Office of the Contract Record,
April 2, 1914.

VANCOUVER is undoubtedly entering upon a season of greater constructional activity than obtained last year, although it is possible that this may not be reflected in the building permits as the returns for last year included the figures for much important work which will be carried to completion this season. The outlook for the year is summed up for this journal by Building Inspector Jarrett in the following terms:

"It is a very difficult matter to predict the outcome of building operations at Vancouver for the year at this time, as there are so many varied conditions existing that have to be considered by the investor. Some of these conditions may improve very materially in a short time and relieve the situation very much, while others may continue as a check for the next few months. Still I am confident that 1914 will be a fairly prosperous year for the building trades here.

"One feature that stands out prominently is the number of fairly good dwelling house permits which have been issued since the beginning of the year. This indicates that our citizens have absolute faith in the future of the city.

"During the last three years a great many large mercantile and office buildings have been erected. While the demand for this class of building is fairly well supplied, I do not think that it is overdone; in fact to my mind there will be a continued demand for these two classes of buildings in Vancouver, though possibly not to the same extent as in the past few years. At the present time there unquestionably exist openings for several good hotel buildings. Quite a number are projected and have been placed in the hands of local architects.

"During the present year the construction of a considerable number of public buildings will be undertaken locally by the Dominion Government, and, in addition, a heavy volume of building construction is projected by the various railroad companies which make Vancouver their Pacific Coast terminus. The most encouraging feature of all, however, in the present situation is the marked increase in the number of enquiries as to warehouse and manufacturing accommodation within the city limits.

"Briefly summing up the conditions prevailing, I feel justified in predicting that 1914 will be a prosperous year for Vancouver and that it is only a question of a short time before we shall be back on the up grade again."

In no other part of Vancouver has constructional progress been more in evidence during the past few months than on the site of the Canadian Pacific Railway Company's new terminal improvement scheme at the foot of Granville Street. The new passenger station, included in the general scheme, which is being erected immediately east of the present passenger station is rapidly assuming shape, and a good idea is now conveyed of the imposing appearance which the building will present when finished. The construction consists of steel frame and reinforced concrete with pressed brick for the exterior facing and stone trimmings. An imposing row of four columns which extend along the front elevation on Cordova Street lend an almost classic touch to the architecture, and the massive store cornices and the stone ornamental work also add a distinctive appearance. The exterior work is almost completed and it is anticipated that the structure will be ready for occupancy early in the coming summer.

The main entrance of the passenger station will be on Cordova Street with the main waiting room located centrally in the station on the street level. Ticket offices serving the several classes of railway and steamship passengers are located at one end of the waiting room, while the other service rooms are all placed immediately adjoining the main waiting room.

On the lower floors of the station are located the baggage rooms, express companies' space, immigrant rooms, supply rooms, and other station facilities not directly used by passengers. Stairways and lifts connect the two levels of the station, and also afford communication with the office floors above. A separate footbridge is carried over the passenger tracks, directly connected with the waiting room at one end and with stairways leading to the track level, giving access to platforms without crossing tracks at grade.

In connection with the improvements under way there will be four passenger tracks with provision for more when required, separated by wide platforms, between the station and the present freight yard. The passenger tracks are to be raised above the present track level to reduce the difference in level between the street and the tracks.

In order to avoid an inconvenient grade crossing and delays to traffic between the city and the company's steamship wharf, a bridge on the line of Granville street extended is to pass over the passenger and freight tracks to the steamship pier and connect directly with passenger accommodations on the pier. Gangs of workers are now engaged in laying the concrete foundations and piers for this viaduct. The footings between the tracks and at the waterfront landing of the bridge are also well on toward completion, and steel structural operations will likely be started from the dock end of the overhead bridge at an early date. The abutments have already been laid at the foot of Granville street in readiness for the viaduct. An incline is also to be built leading from the west side of this bridge to the wharf, giving access to the lower deck of the pier and freight sheds and to the water front. Construction is well advanced on the new steamship station which is being erected on the shore end of the pier for the B. C. coast steamship service. This will be a two-level building, the upper floor being devoted to the passenger business and offices and the lower floor freight, baggage and express.

Another viaduct over the tracks is being built on the line of Burrard street extending northerly with an incline giving access to the present Trans-Pacific pier and other portions of the water front. This important unit of the big scheme is now practically completed with the exception of the "ramp"- the inclined roadway which will lead to the dock level. The removal of the old Dominion Government immigration shed will be necessary before the viaduct can be completed.

The underlying principle of the general design has been [illegible] easy lines of communication between the railway trains, steamers and the city. The designs for the terminal were prepared by Messrs. Westinghouse, Church, Kerr & Company of Montreal, Calgary and Vancouver, in co-operation with the officials of the C. P. R., and the construction [illegible] station and facilities is now being carried out by the [illegible] corporation.

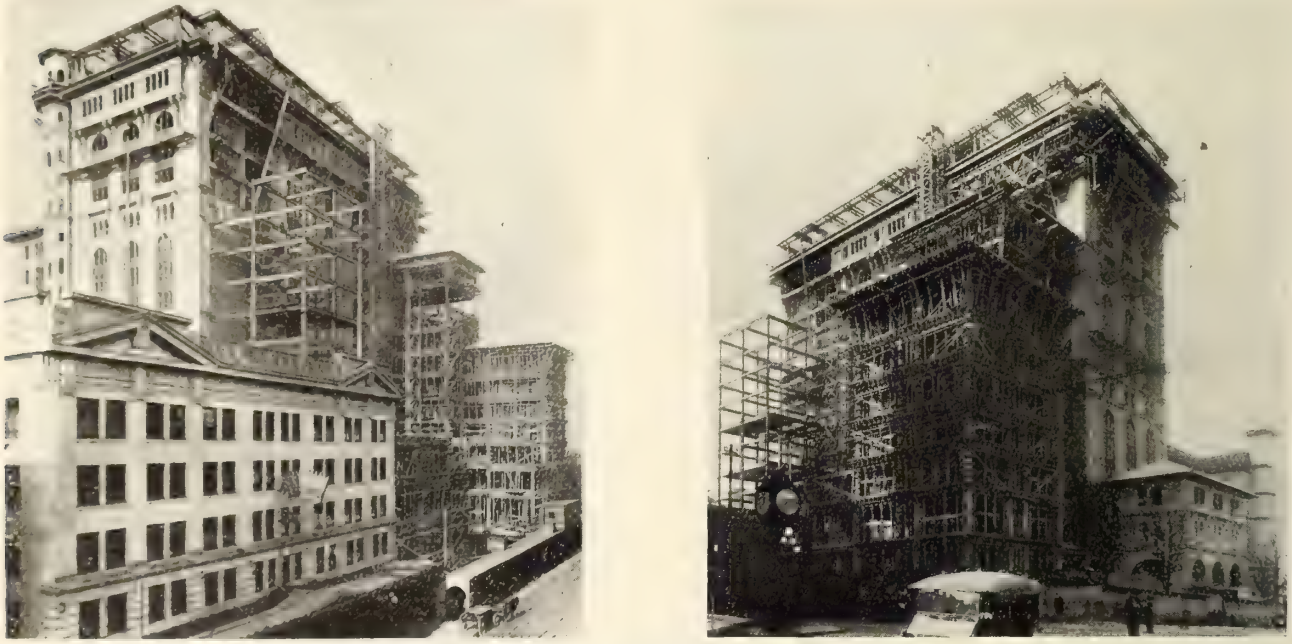
The New Hotel Vancouver

The progress of construction has been very rapid on the Granville Street wing of the new Hotel Vancouver which is being erected at the corner of Georgia and Granville streets for the C. P. R. by the local contracting firm of Skene & Christie. All the steel and concrete work on the north portion of this wing is completed and a start has been made with the exterior facing. The building at this part is eleven storeys high where it adjoins the 16-storey central structure and rises to a height of seven storeys on the Granville Street frontage proper. The steel work is finished on the eleven-storey unit of the south wing and all concrete work is in place in the seven-storey section of this wing. At the present time the contractors are directing all their efforts towards the erection of the steel columns that will carry the cantilever beams over the billiard room and bar which will be located directly in the centre of this wing, in the basement. After these girders have been put in place a start will be made on the steel frame of the convention hall above the billiard room. These two rooms will each measure 50 x 100 feet. The steel work supporting this section of the building will have a 60-foot span, consisting of four girders of about ten tons each. The exterior facing in the main structure fronting on Georgia Street has been completed to a height of twelve storeys and steady progress is being made with the interior where operations are well advanced on the metal lathing, ornamental modelling, marble and tile work, plumbing, plastering, heating and ventilating, etc. The exterior of the handsome porte cochere on Georgia Street is completed and the contractors feel confident that the entire main section consisting of sixteen storeys will be finished by the 1st of July, when the business of the hotel will be moved into this part of the building and operations will be started on the re-modelling of the Howe Street wing. Work on this section will necessitate the demolition of the present six-storey office and rotunda portion and the erection of a new eleven-storey structure in its stead, to conform with the general architectural scheme followed on the Granville Street side. The entire hotel will be completed with the addition of one storey to that part of the Howe Street wing which is of comparatively recent construction. The exterior facing throughout is to be of pressed brick enriched with terra cotta. There will be 700 bedrooms altogether in the building, each having access to a private bathroom. A roof garden with pergola on the 16th storey, measuring 60 x 200 feet, will be one of the outstanding features. The hotel will contain eighteen electrically-operated elevators and when completely finished will compare favorably with the most ornate hotel structure on the continent. A force of four hundred men are constantly employed on the work. Mr. Francis S. Swales, architect for the C. P. R., designed the building on which the total outlay will amount to approximately $2,500,000.

The Weart Block Shaping Up Rapidly

The Canadian Ferro Concrete Company are making rapid headway with the construction of the Weart Block, the immense new office building which is being erected at the corner of Hastings and Richards Streets, Vancouver. Practically all of the exterior facing has been completed and the building is steadily assuming a finished appearance. This structure measures 78 x 120 feet and will be one of the largest office buildings in the province. It is fifteen storeys high and will contain thirty offices on the typical floor. The foundations have been carried to rock, 25 feet below grade, and the basement is fully waterproofed. The construction consists of a heavy steel frame and concrete, the exterior facing on the three lower storeys being terra cotta with a polished granite base. The succeeding eight storeys will be of face brick and the exterior of the four top storeys is to be treated in terra cotta. The spaces between the piers of the two lower storeys are to be finished in marble and bronze. The main entrance corridor has been designed in the same architectural style as the exterior, the walls and floors being or marble with bronze trimmings and ceilings of oak beams and panelling. The main floor is planned so that the corner can be utilized by a banking institution with the main entrance on Hastings Street.

The main corridor will be entered off a general vestibule which leads to the basement stairs on one side, and the bank entrance on the other. The corridor floors will be of terrazzo tile, with marble borders, and oak will be employed



On the left, a view of the New Hotel Vancouver from Granville street, showing four different stages of construction; on the right, a general view of the building.

as interior finish throughout. An approximate expenditure of $700,000 has been estimated for the building, which was designed by Russell, Babcock & Rice, Vancouver. Mr. H. Van Matre is superintending building operations for the contracting firm.

The new Weart building, Vancouver, B.C.

The Hudson's Bay Store Addition

Thanks to the long spell of fine weather at Vancouver during the entire month of March the contractors for the Hudson's Bay store addition were enabled to make excellent progress with this building which is destined to be the handsomest structure of its kind at the Coast. The white terra cotta facing in the Georgia and Seymour street elevations is practically finished and good headway is being made with the pressed brick work in the remaining walls. As will be seen in the accompanying illustration the street frontages have been decorated with rows of Corinthian columns, suitably embellished, and disclose a dignified architectural treatment which is too often lacking in structures of this class. The construction consists of a massive reinforced concrete frame, in which there are over fifty vertical supporting columns each embedded in a concrete foundation which measures 8 feet square at the sub-basement floor, the columns themselves measuring 4 feet square and tapering two inches at every floor. The building occupies a site measuring 146 x 175 feet and is being erected strong enough to carry five additional storeys. The present structure forms only the first section of the departmental store which will ultimately occupy this site, plans being completed for a duplicate building with frontage on Georgia and Granville Streets. The total outlay contemplated will exceed $2,000,000. Messrs. Burke, Horwood & White, Toronto, are the architects and the work of construction is being carried on by Rourke, McDonald & Moncrieff, Vancouver.

The Hudson's Bay Company's new store addition, Vancouver. Note the contrast with the present store shown in the left-hand corner of the picture.

B. C. Telephone Company's Office Building

In pursuance of its general constructional programme, the British Columbia Telephone Company is now erecting on Seymour Street, Vancouver, between Georgia and Robson Streets, a new general office building in which provision will be made for three telephone exchanges the equipment of which will be of the most complete description. The steel frame work of this structure has been finished and the task of putting in the concrete for the basement and lower floors is proceeding steadily. The frontage on Seymour Street is 50 feet, and the depth to a lane, 120 feet. The type of construction to be adopted in this building is steel frame and reinforced concrete work, with pressed brick and terra cotta as exterior facing on the front elevation, and common brick for the side and rear elevations. The decorations of the main entrance will be in marble and tile. The head office of the Telephone Company will have accommodation in this building. Plans for the structure were prepared by Mr. J. Johnson, supervisor of the company's building department.

The contract for a new laundry building which the Cascade Laundry proposes to erect near the present premises in the 800 block, Beach Avenue, Vancouver, has been awarded to the Dominion Construction Company. The new structure is to be a three-storey building of reinforced concrete construction, costing approximately $40,000. It will occupy an area measuring 78 x 104 feet, and will be equipped with an elevator and laundry machinery of the most up-to-date description. Excavating operations on the site are completed and a start has been made with the general contract.

The congregation of Kitsilano Presbyterian Church have undertaken in earnest to a campaign to raise the balance [illegible] fund necessary to start construction of a new church building at the corner of Third Avenue and Vine Street. Almost [illegible] has already been pledged. The building will cost about $65,000 and it is desired to increase the guaranteed subscriptions to $40,000 before undertaking a contract.

Excavation work on the site of the new city hall at Port Moody was completed recently and a start has been made on the construction of the building itself. According to the plans the structure will have a concrete foundation, and will be one and a half storeys high with basement. It will cover an area [illegible] feet. The accommodation will include a council chamber, offices for the mayor, clerk, assessor and engineer, court room and engineer's room, police office and cells. The completed structure will cost approximately $10,000 and will be executed by [illegible]. Mr.

J. H. Bowman is the architect, and the work of construction is being superintended by Mr. Hugh Kerr.

Mr. J. J. Donnellan, a Vancouver architect, has been commissioned to prepare plans for a modern theatre building to be erected in Vancouver for Mr. Alexander Pantages. Constructional details are not available for publication, but work will be undertaken as soon as the necessary preliminary steps are completed. It is understood that Mr. Pantages recently purchased a site in the central part of the city and that while the building will be an addition to the structure now on the property, it will comprise a modern down-town theatre as well as a business office block of the first class.

Plans are being prepared for extensive alterations and additions to the present Orange Hall building at the corner of Hastings Street east and Gore Avenue, Vancouver. It is also the intention of the Society to erect a two-storey lodge hall in the Grandview district for which $18,000 to $20,000 will be appropriated. The additions contemplated to the building on Hastings Street and Gore Avenue will include the erection of two more storeys, making five in all, provisions for an elevator, changing the entrance and other extensive alterations. It is estimated that this contract will run about $40,000.

Important Dock Contract

Evans, Coleman & Evans, Vancouver, have been awarded the contract for a large dock which McNeil Welsh & Wilson, Limited, propose to build on the south side of False Creek, Vancouver, adjoining the G. N. R. bridge. The preliminary work will comprise the erection of a wharf 308 feet long, 176 feet wide, approached by a roadway 200 feet in length, and the reclamation of a tract between the proposed dock and the railway bridge. Separate tenders for the erection of sheds and warehouse buildings will be called when the main portion of the new dock is built. The plans provide for two large buildings 204 x 75 feet, which will flank a central roadway and gridiron landing slip for scows. Additional loading facilities for barges will be provided on the western side of the wharf, and the reclaimed area between the eastern edge of the dock and the railway bridge will be utilized for trackage purposes. A strip 50 feet wide will be filled in to connect the dock with the bridge. The warehouses will be of timber with trussed roof, faced with galvanized iron. The roadway and the scow landings will also be enclosed. Messrs. J. P. Matheson & Son, architects, Vancouver, prepared the plans for the project. The property which is to be developed has 600 feet of water-frontage, extends 400 feet out from the shore into deep water, and has an area of three and a quarter acres. The company intend to use about one-third of the tract now and the rest later. The dock at first will be used by the Great Northern Express and Transfer Company, and its subsidiary concern, the Vancouver Coal Company, of which the new corporation is an amalagamation. Mr. J. D. McNeill is president and managing director of the former, Mr. Nelson Welsh is manager of the allied companies and Mr. W. H. Wilson is secretary-treasurer. The company plans to enter the ocean shipping business and to engage in a general building supplies business at a later date.

The City Commissioners of Saskatoon are considering suggestions offered by Mr. E. Hanson, city electrical superintendent, with regard to the alteration of the present system of pumping the city's water supply. The plan is to utilize the water which it is necessary to pass through the condenser at the power house—some 6,000,000 gallons every twenty-four hours—and instead of returning it to the river to pipe it into a sedimentation basin, filter and use it for domestic purposes. This would render unnecessary a separate pumping plant.

Personal Mention

Messrs. Ross & MacDonald, architects, have moved their western offices from 928 Union Bank Building to 506 Tribune Building, Winnipeg.

Mr. William Pearson was re-elected president of the Winnipeg Housing and Town Planning Association at the first annual meeting on March 24.

Mr. H. Galloway, a well-known Edmonton contractor, has secured an important contract in Kentucky, where he has had considerable experience.

Mr. H. Cameron, who has just arrived in this country from Glasgow, has taken up his duties as assistant manager of Canadian Vickers, Limited, Maisonneuve, P.Q.

Mr. R. P. Blakey, government architect for the province of Alberta, visited Toronto recently in connection with plans which he is preparing for a new prison in Alberta.

Mr. A. M. Bennyman, a well-known resident of Amherst, and for some time superintendent with the Robb Engineering Company, passed away on March 25 at the age of 57 years.

Mr. Vernon C. Lucknow, consulting engineer, Victoria, B.C., visited Toronto last week on business relating to the construction of a new store building at Victoria for the Hudson Bay Company.

Mr. R. Preston, master mechanic of the Canadian Pacific Railway, at Winnipeg, has been promoted assistant superintendent of motive power of the lines west of Winnipeg, with headquarters at the latter centre.

Mr. H. D. Johnson has been appointed to the engineering staff of the Eugene F. Phillips Electrical Works, Limited, of Montreal, as assistant contracting manager. He was formerly with the Canadian-British Insulated Company, Limited.

Mr. J. E. Huot, architect, who has been in practice in Montreal, has joined the firm of Wadsworth & Henderson, architects, the new partnership being known as Huot, Wadsworth & Henderson. The offices are in the New Birks Building, Montreal.

Mr. L. C. Frith, chief engineer of the Chicago Great Western Railway, took up duties on April 1 as assistant to the President of the Canadian Northern Railway. Mr. Frith, whose office will be in Toronto, is a graduate of the University of Cincinnati.

Mr. W. C. Willard, recently Assistant Engineer, Panama Pacific International Exposition Company, has been appointed assistant professor of railway engineering at McGill University, Montreal. Mr. Willard had charge of the design of sewer system of the exposition.

Mr. George H. Strevel, a pioneer citizen of Winnipeg and at one time the foremost railway contractor in western Canada, died at Winnipeg on March 16. Born March, 1836, he was a native of Brighton, Ont., and going into contracting he became one of the pioneer railway builders of western Canada.

Mr. Stewart, of the firm of Messrs. Phillip, Stewart and Lee of Saskatoon, contributed a paper at the March meeting of the Victoria branch of the Canadian Society of Civil Engineers, on the subject of "Construction and Design of open Bridges," referring particularly to the drainage work done in Saskatoon and the machinery most suitable for this particular work.

Mr. A. Charlebois, a contractor formerly of Quebec city, passed away suddenly on March 23 at Montreal. He was one of the best known contractors in the Province of Quebec, having carried out the contract for the building of the east wing, which contains the legislative council and legislative assembly of Quebec, as well as the stone wall which surrounds the grounds.

Mr. Morris A. Zook, consulting engineer, of Plainfield, N.J., recently engineer in charge of the valuation of the Grand Trunk-Wabash joint lines in Canada, has been appointed resident engineer of the division of valuation, Interstate Commerce Commission, with office at Washington, D.C. Since 1904 he has been in private practice, mostly in railway valuation work.

Mr. E. B. Temple, of Toronto, died recently in his seventy-seventh year. The late Mr. Temple took an active part in the construction of the Grand Trunk Railway between Montreal and Quebec, and subsequently he was attached to the Toronto staff of the Canadian Pacific Railway. Some years later he was appointed by the Government to take charge of the harbor development and general waterfront construction work at Toronto, during which he supervised the construction of the walls and cribwalks of the Eastern Gap. He was a member of the Canadian Society of Civil Engineers and also of the Institution of Civil Engineers of Great Britain.

Mr. J. D. McArthur, railway contractor, who is building the Edmonton Dunvegan and British Columbia Railway has subscribed $5,000 and promised an additional $15,000 next year to the Edmonton Industrial. This and other subscriptions are to be contributed to the fund for developing the Viking Gas Field, upon which operations have been commenced by the International Supply Company of Medicine Hat.

Mr. J. W. Dudley Robinson, B.Sc. (Lond.), has been appointed Secretary of the Institution of Municipal and County Engineers (London, Eng.), at a salary of £400 per annum. Mr. Robinson is twenty-eight years of age and was educated at the Mathematical School, Rochester, and the South-Western Polytechnic Institute. To enter upon his new position he resigns a secretaryship in the central offices of the University of London.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The County Council of Oxford has decided to prepare a by-law to raise by debentures the sum of $50,000 for county road construction during 1914.

Messrs. B. Mooney & Sons are the contractors for the new building for the Bank of British North America which is nearing completion at St. John, N.B.

Among recent contracts of considerable magnitude mention must be made of the Severn Division of the Trent Valley Canal awarded last week to the Inland Construction Company, Toronto, at $712,258.

A contract has been let for the supply of the DeVigan brand of Caen stone cement plaster to be used in the palm room of Sir Henry Pellatt's residence, Toronto, of which Mr. E. J. Lennox is architect.

Second tenders have been called for the $400,000 college which is to be erected by the Loyola College, Montreal The architects are Messrs. Peden & McLaren and the closing date is April 17. The structure is to be of stone and fireproof construction.

Montreal's building permits from January 1 to March 31 represent an expenditure of [illegible] permits. In the corresponding period of last year the total was $1,867,847 and the permits were 742. March, 1914, shows an appreciable gain over March of last year, the returns being [illegible] and [illegible]

Permits totalling in value $94,811 were issued in Guelph during March as compared with $39,500 for the same month last year. This brings the total for the first three months of 1914 to $154,189, as against $97,455, which goes to indicate that a record in building construction in Guelph will take place during the present year.

Mr. J. E. Armstrong, of East Lambton is arranging for a deputation to approach the Minister of Public Works at Ottawa with regard to the question of securing supplies of road gravel for Western Ontario from the River St. Clair at Sarnia. The farmers in the township of Enniskillen have offered to haul the gravel free from the railroad sidings and to distribute it.

The Board of Trade, Council and Commissioners of St. John, N.B., have decided to send a deputation to Ottawa to urge further federal aid for the projected bridges across the St. John and Kennebeccasis Rivers. The cost of the project is estimated at nearly $3,000,000, and the Federal Government has already pledged a grant of a million dollars towards the construction.

It is announced that the proceedings of the Commission appointed to investigate the commercial feasibility of the proposed Georgian Bay Canal will be made public, and that the information collected will be given out from time to time. Mr. J. P. Hepbourne, for many years connected with the Great Lakes and transportation matters, has been appointed secretary and will have an office at Ottawa.

A new style of portable metal buildings, particularly adapted to the requirements of contractors and engineers, is being manufactured by the Pedlar People of Oshawa. These structures are made of the highest grade materials, either all-steel or metal-clad. They are easily transported from place to place and afford protection against fire in out-of-the-way places. They are particularly suitable for railway buildings, such as tool-houses, shelters, freight-sheds, and so on. [illegible]

Mr. J. G. Carey, C.E., of the firm of Carey and Chase, addressed the Civil Engineers' Club in the mining building of Toronto University on March 26, his subject being "Moose Factory as the terminal of the Temiskaming and Northern Ontario Railway." He pointed out that besides the projected line of the Ontario Government to Moose Factory, the Manitoba Government contemplated constructing a line east from Winnipeg to Port Nelson, and the Quebec Government will lay a line from Montreal to Rupert House

The number of building permits issued from the city architect's department, Toronto, during March, 1914, total [illegible] representing 990 new buildings at a value of $2,550,[illegible]. The total for the three months of the present year is estimated at $4,598,685. The permits issued during March, 1913, were 515 representing 795 buildings and a money value of $2,004,285. The value of the permits issued for the first three months of 1913 was $4,891,579, which shows a reduction of $292,894 on that for the corresponding period of last year.

Mr. J. K. L. Ross has made an offer to the hospital authorities of Montreal to contribute the balance of between $250,000 and $300,000 to erect and endow a new private pavilion in connection with the Royal Victoria Hospital, for which a few thousand dollars had already been subscribed. The new pavilion will be erected immediately behind the main building and will be a separate structure probably with a covered passage connecting it with the hospital proper. Architectural plans will be called for immediately and construction started as early as possible.

Mr. J. R. Ambrose, chief engineer for the Toronto Terminal Railway Company, will open tenders this week for the building of the new Union Station. The officials claim that it will take about two weeks to consider the contracts before they are awarded . This means that the work cannot be started until the end of April. The officials of both the G. T. R. and C. P. R., with their architects, have agreed on the details of the plans. The consulting engineers are Chief Engineers H. R. Safford and J. M. R. Fairbairn of the G. T. R. and the chief engineers of the Canadian Pacific Railway.

Mr. A. D. Swan, member of the Institute of Civil Engineers, who recently enquired into the suitability of the St. Croix River, Charlotte County, N.B., for a deep water harbor which would be open all the year round for merchant shipping of the largest class, has reported to Hon. Robert Rogers, Minister of Public Works, recommending that wharf areas, railway terminals, road and freight handling facilities in general, should be designed on a comprehensive, practicable scale and constructed by degrees at Oak Bay at a cost, not including purchase of site, of about $2,250,000.

By a majority of 1,308, the citizens of Ottawa have approved by plebiscite the Currie-McVeity water supply scheme, which provides for rapid sand mechanical filtration of the water from the Ottawa River. The total vote in favor of this scheme was 7,544 and for the 31-mile lake, 6,236. The source of supply in the approved scheme is a point above the Chaudiere rapids where contamination is practically nil. From a point in the Little Chaudiere and the Remic rapids two intake pipes will convey the water to a pumping station with electrically driven pumps. From here the water will be forced to the purification plant and reservoir which it is proposed to establish. The system of purification includes sedimentation and coagulating basins through which the water will flow by gravitation to the sand filter beds and through it into the pure water reservoir, designed for a capacity of 10,000,000 gals. of filtered water. The total estimated cost of the plant, together with engineering expenses, etc., is $1,700,000.

St. John, N.B., is making much progress as illustrated by the extensive harbor developments, the establishment of new industries and the enlargement of its housing accommodation. The city and county are to erect this year a hospital for advanced cases of tuberculosis at a cost of $85,000 and the municipality has also secured authority from the Provincial Legislature to make a large bond issue to erect a general hospital. The work of remodelling the larger building at the corner of King and Jermain streets, to be used solely by the Canadian Pacific Railway and the Dominion Express Companies, is now in progress, and when the work is complete the Canadian Pacific will have extensive general offices for all its departments under one roof. The steel frame of the new post office is now completed and the work of the outer walls and interior will be finished in the spring and summer months. Mr. W. U. Humfray, an English capitalist, who has made large investments in St. John, has brought from England the information that representatives of three large manufacturing concerns are coming to St. John to look into the question, selecting that city as the site for the location of branch factories for Canadian business. If this scheme materializes it should mean much industrial expansion for St. John.

WESTERN CANADA

If the plans of the Empire Theatre materialize, the city of Edmonton will have another ten-storey office building at a cost of $600,000.

At Edmonton, Alta., an eight-storey addition is to be built by the Y. M. C. A. at a cost of $400,000. Messrs. Magoon & MacDonald are the architects.

The town of Kindersley, Sask., is making preliminary surveys for a reservoir estimated to cost $125,000. Operations will not be commenced this year.

Operations are to be resumed on the club and apartment house for the Northern Club, Edmonton, Alta. The building will be seven storeys high, of steel construction, and will cost $250,000.

During the summer, Messrs. R. J. Lecky & Company will build the superstructure of the new traffic bridge across the Saskatchewan river at Saskatoon. The cost of the bridge is placed at $398,000.

Plans are being prepared for a new bank building, estimated to cost $250,000, at Edmonton, for the Bank of Alberta. The structure will be six storeys high, of granite construction finished in marble.

The Saskatoon builders' exchange passed a resolution recently requesting the city council to appoint a city engineer forthwith, who would have charge of all construction contracts and report direct to the Mayor and city council.

It is reported that the public works department of the Dominion Government have purchased a lot and water frontage out to Channel Bank at Port Lambton, with the intention of constructing a landing and a customs and immigration office.

A new public school is being erected at Swift Current, Sask., by Messrs. Reid, McDonald & Brewster, of Edmonton, Alta., at a cost of $155,000. The heating and plumbing contract has been let to Messrs. Frost Brothers, of Swift Current and Moose Jaw.

Mr. W. E. Cox, a Winnipeg engineer, advocates the vacuum steam heating system which he contends would effect a saving of at least 10 per cent. in cost of coal consumption in the new Mayfair school in course of erection. The system has been tried in a number of Canadian cities with gratifying results.

Messrs. Carter, Halls & Aldinger are making good progress with the erection of the new Winnipeg building for the Bank of Quebec. The building is four storeys high, of steel and concrete construction, and involves a cost of $225,000. Messrs. Brown & Vallance, Montreal and Winnipeg, are the architects.

"Carelessness in building construction is the chief cause of Saskatchewan fire losses" said Mr. R. J. McLean, provincial fire commissioner, at Regina recently. He also stated that the municipality which insists on rigid enforcement of the regulations for the protection of property from fire might bring about a substantial reduction in insurance rates.

A new warehouse and office building has been completed for the Massey-Harris Company, on Eleventh Avenue, Calgary. It is a handsome four-storey, solid brick building and will be the future home of the Calgary branch of the Massey-Harris Company. Mr. D. H. MacKay was the supervising architect and the Union Building Company of Calgary, contractors.

City Engineer Rust has returned to Victoria, B.C., after a trip to Seattle, where he inspected the method by which the pavement on streets on which car-tracks are laid, is protected. A new type of paving brick is now being manufactured there and it is the intention to use vitrified paving brick or wood blocks alongside the street-car tracks on all future pavements.

The contractors are working two shifts daily on the construction of the 25th Street bridge at Saskatoon, and also on the fifth pier. An immense cable has been stretched across the river slightly to the south of the piers and to this will be attached scows for use in building the sixth pier in midstream, the construction of which proves to be the most difficult problem with which the contractors are faced.

The construction of the new 2,000-ton smelter for the Granby interest at Goose Bay, B.C., was completed recently and everything is in running order in preparation for the continuous smelting of that valuable copper ore known as the Hidden Creek property. The announcement was made by Mr. F. M. Sylvester, manager, that four hundred men will be employed to run the smelter, and a similar number in the mine.

Mr. J. P. Forde, district engineer of Revelstoke, B.C., made the announcement that with the exception of the wharf at Kaslo, and the new wharf at Ainsworth which is to be constructed of cement, the Dominion public works department has practically completed its winter programme on Kootenay Lake and the west arm. Mr. J. Dancy, of Nelson, is the contractor for the cement wharf at Ainsworth, which promises to be one of the finest structures of the kind in British Columbia.

Dr. M. H. Seymour, commissioner of public health for Saskatchewan has written Saskatoon city officials stating that he must refuse to sanction any more sewer extensions this year unless the city starts the construction of a sewerage disposal plant, which will obviate the necessity of depositing sewage untreated into the South Saskatchewan river. The city, recognizing the need for a sewage disposal works, have already purchased a site and the greater part of an intercepting sewer has been constructed at a cost of over $300,000.

As the outcome of a discussion between a deputation from Coquitlam municipality and the members of the Burnaby waterworks, the municipality will request the Railway Commission for its sanction to a level crossing over the Great Northern Railway tracks. Mr. F. M. MacPherson planned to raise the present bridge 6 ft. and to make the necessary fills for the new grade. The high-level steel bridge ordered by the Railway Commission last year has yet to be built, but drawings of a superstructure will be submitted at once for selection.

Civic improvements under way at Vancouver will cost approximately $20,000,000, all of which at the present rate of construction will be expended within the next two or three years. Plans for the construction of a railway bridge across Burrard Inlet to North Vancouver, which will cost an additional two and a half million dollars, have been approved by the Dominion Government. The money for this project is already provided and work will be commenced this spring. The cost of construction will be shared by the Dominion and Provincial governments.

The first annual meeting of the Winnipeg Housing and Town Planning Association, which was held on March [illegible] under the presidency of Mr. William Pearson, decided by unanimous vote to affiliate with the industrial bureau, continuing, however, under its present form of organization. All work undertaken in connection with housing and town planning will be carried on in the name of the Winnipeg Town Planning Association of the Industrial Bureau. Mr. J. D. Atchison pledged the system to stand behind a request to be made to the city council for the passing of legislation providing for a limit to the height of all future buildings in Winnipeg.

The Elm Park Company's new steel bridge connecting Elm Park with the city of Winnipeg, was opened for traffic on March 14. The substructure consists of concrete piers, abutments, etc. The steel superstructure, which was erected by the Dominion Bridge Company, Limited, consists of a swing span 278 ft. long, a fixed span 222 ft. long and an approach on the south side about 100 ft. long. It has a 16 ft. roadway and an 8 ft. sidewalk. The floor of the bridge is about 25 ft. above the summer water level in the Red River, consequently it will only be necessary to open the swing span for the largest passenger steamboats. The entire work in connection with the bridge has been carried out under the supervision of Professor E. Brydone-Jack as consulting engineer, and Mr. A. S. Innes as field engineer. The total cost of the structure will be about $125,000. Messrs. Fowler & Young were the contractors.

In a recent issue of this journal it was announced in the Contracting Department that the Union Contracting Company, Limited, had been awarded the contract for four viaducts at Vancouver, estimated to cost $300,000. At our request the Supervising City Engineer, Mr. F. L. Fellowes, has very kindly furnished details on this project. These viaducts are to be built according to the "Mushroom" system of reinforced concrete. They are designed and are being built to eliminate the level crossing at Hastings, Pender, Keefer and Harris streets, over the Great Northern Railway Company's right-of-way. The cost devolves mostly upon the Railway Grade Crossing Fund and the Victoria, Vancouver and Eastern Railway Company. The B. C. E. R. Company and the city are also interested. Maintenance is divided equally between the city and the Victoria, Vancouver and Eastern Railway Company. The bridges on Harris and Hastings streets will be double-tracked for the B. C. E. R. Company, who operate the street car service at Vancouver. The designs were prepared by the City Engineer's staff with Mr. Turner in a consulting capacity.

Mr. H. W. Bassett, a partner in the firm of Messrs. Grant, Smith & McDonnell, to which the Dominion Government has awarded a $2,250,000 contract for the construction of the proposed ocean docks at Victoria, made a personal inspection of the sites recently and announced that before long plans will be assembled for the commencement of operations. Office quarters for the clerical staff will be erected on Dallas Road convenient to the work. Local labor and home manufactured equipment will be employed as far as possible. According to Mr. Bassett, the material to be used in the wharves will consist of reinforced steel, cement, lumber, rock, sand and gravel. The firm of Messrs. Grant, Smith & McDonnell has been identified with various important constructional undertakings including the boring of a tunnel from the Catskill Mountains into New York, the contract involving an expenditure of five million dollars, and which is almost completed. The company was also engaged in a large amount of [illegible] on the British Columbia line of the Canadian Pacific Railway. Apart from this work the firm have also carried out much of the grading of the Canadian Northern Pacific Railway [illegible] undertakings on Vancouver Island [illegible] in connection with the local [illegible]

Canadian Railroad Development

In connection with the proposed line for the Calgary and Fernie Railway, five parties of engineers are said to be in the field surveying routes for extensions north and south and branches east and west. The charter for the Calgary-Fernie line was secured by a concern known as the Grain Belt Company, composed of Eastern Canadian and London financiers, and the route is understood to be ready for contractors to commence construction.

The American Car Company have constructed a number of tank cars especially equipped for fire-fighting, to the design and order of the Canadian Pacific Railway. The idea, which is a new departure on the part of the Canadian Pacific Railway, is to operate the cars in pairs each car carrying a tank of 8,438 Imp. gallons and on the end of each car there is a 20 in. x 10 in. duplex fire pump using steam from the locomotive boiler. At the other end is a rack construction on which can be carried 6,000 ft. of fire hose. The car is designed for weight capacity of 100,000 lbs. and Standard 50-ton trucks are employed.

The Grand Trunk Pacific Railway's building schemes at Prince Rupert, B.C., are being steadily advanced. Some of the larger works with their estimated cost at completion include the following:—Dry dock $2,750,000; fifteen-storey hotel $2,000,000; terminal facilities, including docks, depots, shops, etc., $2,500,000, for the Dominion Government; post office $250,000; court house and administration office building $300,000; hydro-electric plant (first unit) $380,000; sewerage system and waterworks extension $500,000; section two bridge, erected by the Imperial Oil Company $100,000; five large storage tanks $200,000; making a total of $9,180,000.

The Canadian Pacific Railway is engaged in completing its line from Golden to Fort Steele in the mining country of British Columbia. The company expects to operate trains over it by the end of the summer in order to open up the valley of the Kootenay and Columbia River, which contains valuable silver and lead ore deposits. The five-mile tunnel through the Selkirk Mountains at Rogers Pass, when completed some time next year, will eliminate about four-and-a-half miles of snow sheds and heavy gradients. The tunnel will give the company practically 2.2 per cent. grade through the mountains and an almost water level route from the Pass to the Vancouver terminals.

Work on the C. N. R. bridges from Montreal to Pembroke is now ready for steel according to an anouncement made recently by Colonel Greenwood, assistant chief engineer of construction. The two bridges across the River des Prairies have eight piers and four abutments and the large structure across Mille Isle river has fourteen piers and two abutments. The masonry work has been completed and the bridge companies have already begun work on the superstructures. Between Ottawa and Pembroke the Ottawa river is crossed twice, at Fitzroy harbor and at Portage du Fort, by bridges of 1600 and 1800 ft., respectively. The last-named bridge has three spans of the superstructure in position. The contract for grading, bridge-building and track-laying from Montreal to Hawkesbury and from the Capital to Pembroke is being carried out by Mr. J. P. Mularky.

One of the officials of the Pacific Great Eastern Railway Company made the announcement a few days ago that the survey of the Peace River extension of their line had already commenced. The Lieutenant-Governor of Victoria has given his assent to the act passed at the last session of the Provincial legislature, authorizing the construction of the road and guaranteeing the company's bond to the extent of $35,000 a mile, the terms of the contract requiring the starting of operations within three months. The line is to penetrate a distance of 330 miles into the Northland to the eastern boundary of the province. Regarding the main line between Clinton and Fort George, where a junction is to be affected with the Grand Trunk Pacific Railway, it is announced that preliminaries will be completed shortly, when the entire project from Vancouver to the junctional point will be in the hands of representatives of the contractor. The February report regarding the right-of-way from the Coast to Clinton indicates that about 4,000 men have been engaged.

Construction work is now proceeding on that portion of the Kettle Valley railway, which will link up the Canadian line with the V. V. & E., at Princeton. Authorization for a change in the route as originally planned was given at the recent session of the Provincial legislature, the change being previously approved by the Dominion government. Pending this decision a ten-mile section has been commenced which will form part of either the original or the proposed new route, and at present gangs are at work over the remaining 23 miles of the 33-mile section between Osprey Lake and Princeton. The provisions of the Kettle Valley railway bill which was recently passed by the province, relieved the company from constructing its line to Otter Summit from Osprey Lake, the Kettle Valley having arranged for using the V. V. & E., via Princeton to the former point. A similar agreement exists between the two railways with respect to the use of the section between Coquahalla Summit and Hope. Work is said to be well advanced on the latter portion of the Hope Mountain route. About 1,600 men are employed on the grading operations on the joint section.

An official of the Canadian Pacific Railway, who has just completed an extended tour of the Canadian West and the northwest section of the United States, reports that business conditions in these territories are essentially sound; that the western business man is building carefully and conscientiously toward future prosperity and is in practically every sense becoming as much a man of affairs as is the easterner; that Vancouver is preparing actively for the opening of the Panama Canal and that business generally is expanding. In the words of this official, Vancouver is probably doing more than any other Pacific coast city towards preparing for the traffic certain to follow the opening of the Panama Canal. Government and private capital is being liberally expended to make it one of the best ports on the Pacific seaboard. Among other important operations under way is the Canadian Pacific Railway's new terminal for trains and vessels, which will cost more than $3,500,000. The terminal with most of its adjuncts, such as siding yards, round house and repair shops, will be completed some time this year. The new $2,000,000 hotel now being erected by the Canadian Pacific is nearing completion.

The 1914 edition of "5000 Facts about Canada," compiled by Frank Yeigh, contains much that is interesting and instructive to the constructional world. Mr. Yeigh's researches appear to have been carried out in all the multitudinous byways of human activity and there appear to be few shortcomings—none that we can find—in his excellent publication. There are facts about the cities and the provinces, individually and collectively; there are facts about the natural resources of the country and of the various branches of constructional development; there are trade facts, banking facts, population facts and all the other facts which go to make up an encyclopedia of information expressed within the dimensions of a volume which may be carried in the vest pocket. The publishers are the Canadian Facts Publishing Company, 588 Huron Street, Toronto.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Barrie, Ont.

Plans have been drawn for the laying of approximately 450 ft. of 12-in. glazed tile sewer pipe on Bradford St. It is also proposed to lay a sewer on Charlotte St. Engineer-in-charge, K. S. Macdonell.

Belleville, Ont.

The laying of asphaltic concrete pavement on Front St. and a portion of Bridge St. has been recommended to the city council.

Blandford Twp., Ont.

Tenders for drain construction will be received by the Township Clerk, Geo. Oliver, Bright, Ont., until April 11th. Plans at the offices of the Engineer and the Clerk. The material required is approximately 1,600 ft. 16-in. tile; 2,400 ft. 14-in. tile; 600 ft., 12-in. tile; 3,130 ft., 10-in. tile; 606 ft., 8-in. tile; 452 ft., 5-in. tile; 8 catch basins. Engineer-in-charge, F. J. Ure, Graham St., Woodstock.

Calgary, Alta.

Tenders for water meters are about to be called by the city council. Engineer, A. W. E. Fawkes, City Hall.

County of Carleton, Ont.

A by-law, authorizing the expenditure of $40,000 on road improvements was recently passed by the ratepayers.

Hamilton, Ont.

The work on the laying of asphalt pavements will be done during the year by day labor, under the supervision of the City Engineer, A. F. Macallum.

Inwood, Ont.

Tenders will be received by the chairman of the town council until April 11th, for the construction of the McKinley and Hayter drains.

Kindersley, Sask.

Surveys are being made to estimate the capacity and approximate cost of a reservoir, but it will be several years before the work can be undertaken.

Ottawa, Ont.

Owing to price tendered on the construction of the pump and tank house at Dundonald Park on the first design, the plans have been modified. These with the specifications are at the office of the City Engineer who is receiving tenders.

The question of the source of the water supply was decided by a plebiscite on March 30, when the scheme for the mechanical filtration of the Ottawa river water was favored by the ratepayers.

Quebec, Que., Montcalmville

The city has been authorized to borrow the sum of $2,000,000 for permanent work all over the city.

Regina, Sask.

Specifications for the construction of sewers are being prepared. It is estimated that about 85,000 lineal feet will be laid.

Specifications for waterworks supplies are being prepared by J. M. MacKay, Supt. of Waterworks. (B) 1310 tons 4-in., 6-in., 10-in., 16-in. and 24-in. cast iron pipe. 100 tons specials; (C) 65 tons ¾-in. lead pipe, 4,000 lin. ft., ½-in. galvanized iron pipe, 250 lin. ft. ¾-in. and 2,000 lin. ft. 2 in. galvanized iron pipe and coupling. 1,000 lin. ft. 1-in. Black pipe. ,000 lin. ft. Braided Jute rope. 75 tons pig lead; (D) 100—4in-., 6-in., 8-in., 16-in., 24-in., iron body gate valves, (Kelfie Brand), 95 valve boxes for 6-in., 8-in., 10-in., 16-in. and 24-in. valves. 90, 2 ways and 15 3 ways, Ludlow Patent 6-in. fire hydrants. 50—2-in. brass gate valves; (E) 1200 ¾-in. and 25—2-in. corporation cocks, 1,200 ¾-in. curb cocks, 75 ¾-in. lead to lead unions, 1,200 No. 2 curb boxes.

Saskatoon, Sask.

The City Commrs. have recommended that tenders be called for sewers in 3rd Ave., Ave. E. and 33rd St. and that the lowest tender received last year for sanitary sewers on Saskatchewan St., intercepting sewer from Ave. D. to 11th St. and force main on 11th St. be accepted and the work started this year.

Tenders will be received by the City Commrs. until noon April 23rd, for the construction of approximately 3,555 lin. ft., 8 in. and 10 in. sanitary sewer; 3,577 lin. ft., 6 in., 8 in. and 10 in. cast iron watermain, including setting and constructing all necessary gate valves, valve chambers and manholes, also approximately 8,648 lin. ft. storm sewers, including catch basin connections, ranging in size, from 8 in. to 24 in., with the necessary manholes, catch basins, etc. Junius Johnson, the Acting City Engineer, will supply further information.

Simcoe, Ont.

[illegible] council for the construction of sanitary sewers on 17 streets, at an estimated cost of [illegible]

Stratford, Ont.

Tenders will be received by the Engineer, A. B. Manson, until 5 p.m., April 20th, for the construction of 12,000 sq. [illegible] sq. yds. one course concrete pavement, 12,650 lin. ft. concrete curbing.

St. Chrysostome, Que.

Tenders will be received by the Sec.-Treas., J. E. Dedome, until April 15th, [illegible] Specifications are at the office of the [illegible]

Swift Current, Sask.

Tenders will be received by the City noon April 20th for 45,000 cu. yds. street grading. Plans and specifications at the office of the Engineer, Geo. D. Mackie. Clerk, Geo. D. Arnott, up to 12 o'clock

Tenders will be received by the City Clerk, G. D. Arnott, up to 12 o'clock noon April 20th, 1914, for 16,000 lin. ft. combined sewer and waterworks extensions. Plans and specifications are with the Engineer, Geo. D. Mackie.

Toronto, Ont.

Tenders will be received by the Board of Control until April 14th for the laying of asphalt on four streets, brick block on one lane, concrete pavements on ten lanes, and concrete walks on 42 streets. Plans are at the office of the Commissioner of Works.

Tenders will be received by the Board of Control until April 14th, for the excavating, laying and jointing of water pipes, valves, hydrants and special castings for year 1914. Specifications, etc., are at Room 9, Waterworks Section.

Estimates for work under the good roads system have been prepared and the amounts to be spent this year are as follows:—Rainy River, $85,000; Kenora, $35,000; Port Arthur, $60,000; Fort William, $90,000; Sudbury, $50,000; Sudbury Soo Trunk Line, $90,000; Sudbury North Bay Trunk Road, $50,000; North Bay Mattawa Trunk Line, $50,000; Haileybury & So. Lorraine, $15,000; Elk Lake District, $20,000; South Porcupine, $20,000; Charlton Colonization Road, $35,000; Road along T. & N. O., $120,000; Road along N. T. R., $105,000; Mattawa to Pembroke, $15,000; Larder Lake Mining road, $5,000.

Tenders will be received by the Board of Control until April 14th, for the construction of sewers on Claude, Edgewood, Glenmanor, Innes and Melgund St., Paton Rd., Queen St., Scarborough, Windeat and North Toronto Grade Separation.

Victoria, B.C.

The time for receiving tenders for a semi portable asphalt paving plant has been extended to April 30th. City Engineer, C. H. Rust. Purchasing Agent, W. Galt, City Hall.

Whitby, Ont.

The town council has instructed the Engineer, T. Aird Murray, to prepare working plans for the construction of [illegible]

Winnipeg, Man.

Tenders will be received by the Board of Control till April 22nd, for the supply of [illegible] tons asphalt flux and 8,000 to 12,000 cu [illegible]

CONTRACTS AWARDED

Ford City, Ont.

[illegible]

cipal Council to Emile Clarehaut, Alter Rd., Fox Creek, Mich.

Toronto, Ont.

The contract for laying sewers on Danforth Ave. from Main to City Limits at $30,200, and from Woodbine Ave. to Main St. at $21,300, has been transferred from the Commr. of Works to J. H. McKnight Construction Co., 88 St. David Street.

The contract for laying asphalt pavement on Danforth Ave. from Greenwood to Roseheath, at $47,156; from Roseheath and Westlake, at $44,400; and from Westlake to City Limits, at $41,821, has been transferred from the Commr. of Works to Godson Contracting Co., Manning Chambers.

Vancouver, B.C.

The contract for the supply of sewer pipe has been awarded by the city council to The Dominion Cement Pipe Co., Ltd., Vancouver.

Winnipeg, Man.

The following contracts have been awarded by the Board of Control. E. F. Campbell, Supt. Asph. No. 2 Constr., sewers in Ashburn St., $547.13; Warsaw Ave., $142.80; Sargent Ave., $1,554.80, and Boyce Ave., $1,394.40. J. W. Astley, Engineer of Constr., Seymour St., $1,527.95.

Railroads, Bridges and Wharves

Barrie, Ont.

Tenders will be received by the Town Engineer, K. S. Macdonell, until noon April 30th, for the construction of a concrete storm culvert on Toronto St., 67 ft. long by 6 ft. wide, and one on Sophia St., 66 ft. long by 6 ft. wide.

Burford, Ont.

Tenders will be received by the Township Clerk, F. W. Taylor, R. R. No. 3, Burford, until noon, May 2nd, for the manufacture and erection of a class "B" steel highway bridge over Whitman's Creek on the side-road 1 mile north of Burford. Specifications at the office of the engineer, Alan Mair Jackson, Temple Building, Brantford.

Calgary, Alta.

A further recommendation of the bridge committee is that the addition of a 6 ft. low level deck be made to the proposed concrete bridge across Bow River at Centre St., at a cost of $12,000.

North Cayuga Twp., Ont.

Tenders will be received by the council until noon May 2nd, for the construction of a concrete arch bridge over Teasdale's Creek.

Forest, Ont.

The construction of a fruit shed and siding is being considered by the Grand Trunk Railway.

Gleneden, B.C.

Tenders for the construction of a 602 ft. wharf will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. May 4th. Plans, etc., are at the offices of Dist. Engineers, Chase, B.C., New Westminster, Postmaster, Salmon Arm, B.C., and the Dept., Ottawa; and at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Joliette, Que.

It is expected that the Public Works Department will call for tenders shortly on the construction of a bridge.

Jonquieres, Que.

Tenders for the construction of a wharf will probably be called by the Public Works Department. Secretary, R. C. Desrochers, Ottawa, in about a week.

Knowlton Landing, Que.

New tenders for the reconstruction of the wharf are called by the Public Works Dept., Sec., R. C. Desrochers, Ottawa, as none of the former tenders were accepted.

Montreal, Que.

The construction of an overhead equipment and rolling stock for 15 miles of railway has been decided upon by the Montreal Southern Counties Rly. Co. Can. Express Bldg. Specifications are at the office of the Engineer-in-charge, W. B. Powell, who will receive tenders until April 15th.

Port Sydney, Ont.

The rebuilding of the dam will probably be undertaken by the Public Works Dept. this year.

Shoal Lake, Man.

Tenders will be received by the Commissioner of the Greater Winnipeg Water Dist., 901 Boyd Bldg., Winnipeg, up to May 15th, 1914, for the construction of a dyke across the end of Indian Bay, to contain about 220,000 yards of filling.

St. Croix, N.B.

Hon. Robt. Rogers, recently assured a deputation that harbor improvements would be made shortly.

Toronto, Ont.

Plans for the new Union Station are nearly completed, and tenders will be called shortly. Mr. J. R. Ambrose of the G. T. Rly. is the engineer.

CONTRACTS AWARDED

Armitage Landing, Ont.

The wharf contract has been awarded by the Public Works Dept. to McColl & Moffat, of Ft. William and Pembroke, respectively.

Cobourg, Ont.

The contract for the construction of the central pier has been awarded by the Public Works Dept. to Randolph, McDonald Co., Queen and Victoria Sts., Toronto.

Howard Twp., Ont.

The contract for the construction of the bridge and flood gate has been awarded by the Township Council to James E. Doyle, Cross St., Chatham.

Nicollet, Que.

The wharf contract has been awarded by the Public Works Dept. to M. Bernatchy, Montmagny, Que.

Ottawa, Ont.

The contract for the second section of the Severn division of the Trent Valley Canal has been awarded by the Public Works Dept. to The Inland Constr. Co. of Toronto, at $712,258.

Saugeen Twp., Ont.

The contract for the substructure of the "Goldberg" bridge, has been awarded to James McKinnon, of Gresham.

Woodstock, N.B.,

The contract for the construction of stations, platforms and shelters has been awarded by the St. John & Quebec Ry., Fredericton, N.B., to McLaggen & McBean.

Public Buildings, Churches, Schools, etc.

Alvinston, Ont.

Tenders for the construction of a church and sheds, on River St., for the Presbyterian Church Congregation will be received by P. A. McDiarmid until 5 p.m. April 21st. Plans, etc., are at the office of Sec. and the Architect, W. G. Murray, Dom. Savings Bldg., London.

Aylmer, Ont.

It is understood that a site satisfactory to the Government has been selected for the erection of the armoury.

Berlin, Ont.

Plans for school additions at a cost of $20,000, have been drawn for the Board of Education of which Chas. Knechtel, Glick Block, is the architect.

Brantford, Ont.

A proposal has been submitted to the city council regarding the erection of a closed Sanitary Fireproof Market, properly heated and lighted. Options have been secured on property on Darling St. suitable for a site.

Calgary, Alta.

The Dominion Government has purchased the Merchants Bank Bldg., which will be remodelled for the Receivers General office building. Architects, Brown & Vallance, 189 St. James St.

Chicoutimi, Que.

Plans are in progress, and tenders will be called next month for the erection of a school for Les Commrs., d'Ecole Chicoutimi. A. Lamontagne is the architect.

Douglastown, N.B.

Mr. Ernest Hutchison is interested in the projected building of a hall to be used by different societies; cost $5,000 to $7,000.

East Angus, Que.

The Public Works Department will shortly call tenders for post office fittings.

Tenders for the erection of a public building will be received by R. C. Desrochers, Secretary, Public Works Dept., Ottawa, until 4 p.m., April 27th. Plans, etc., at the office of R. L. Deschamps; General Post Office, Montreal; Post Office, East Angus, and at the Department, Ottawa. Specifications also at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Edmonton, Alta.

A by-law is to be submitted to the ratepayers to raise funds for the erection of an incinerator with a capacity of 100 tons daily. Estimated cost $130,000.

Plans for the erection of a bishop's palace and a seminary on the Garneau Sub-division, for the Roman Catholic Denomination are being drawn by R. W. Lines, architect, Can. Permanent Bldg.

Work on the former building is to start this summer.

Plans for the erection of the new Roman Catohlic Cathedral have been drawn by R. W. Lines, architect, Canada Permanent Bldg. The work is to start at once.

Plans for an addition to the Y.M.C.A. are being drawn by Magoon & Macdonald, architects, 604 Tegler Block. The estimated cost is $400,000.

The Beverly Heights Methodist Congregation contemplate building a church to seat 300 people. Further information will be given by Rev. W. A. Lewis, 1816 27th St., Edmonton.

Exeter, Ont.
The School Board proposes to enlarge the public school; additional seating, blackboards, etc., will be required. The estimated cost is $6,000.

Fredericton, N.B.
Plans for the erection of a school on Smythe St., have been drawn for the School Board by G. E. Fairweather, architect, 4 Germain St., St. John. The estimated cost is $37,500.

Gaspe, Que.
Tenders for the erection of a church for the Roman Catholic Denomination will be received by Rev. M. Richard, curate, until April 11th. The estimated cost is $15,000.

Goderich, Ont.
Certain alterations to the Victoria St. Methodist Church are proposed. A new roof is required, and new sheds will be erected.

Haileybury, Ont.
Plans for the erection of a school building at Moore's Cove for the Bucke School Dist. No. 5, are at the office of Eddis & Co., architects, Montgomery Block, who invite tenders until noon April 30th.

Halifax, N.S.
Tenders for the erection of a hall and club on Gottingen St., for the St. Joseph's Catholic Temperance Society, St. Joseph's Hall, are invited by W. J. Busch, architect, 60 Bedford Rd. Tenders received by architect.

Hamilton, Ont.
It is understood that plans for general alterations to the hospital, on Barton St. E., are not yet ready. Stewart & Witton, 7 Hughson St. S., are the architects.

A site at the corner of Huron and Stirton Sts., has been secured for the East End Branch of the Y. M. C. A. Mr. H. Banwell, of the Banwell-Hope Wire Fence Co., is interested in the project.

Hanover, Ont.
Tenders for the erection of a church for the St. Matthews Lutheran Congregation will be received by the Sec. Treas., D. Weppler, until April 15th. Specifications are at the office of the Collector of Customs. The estimated cost is $18,000.

Kamouracka, Que.
Plans for a new [illegible] Catholic Church are being [illegible] by [illegible] llett, architect, 28 Ste. Famille St., Quebec.

London, Ont.
Watt & Blackwell, Bank of Toronto Bldg.,. are the architects for the new 8-roomed school on Grand Ave.

Plans for certain alteration to the collegiate on Dufferin Ave., have been drawn for the Board of Education by McBride & Gilbert, Edge Block. The estimated cost is $25,000.

Mahone Bay, N.S.
The ratepayers have approved of the proposal to erect a school building at a cost of $18,000. Mr. W. F. Joudry is the secretary to the School Trustees.

Marlboro Twp., Ont.
Tenders for the erection of a 2-room school for school section No. 8 are invited by the Sec.-Treas., Robt. MacKay, North Gower, until April 10th.

Medicine Hat, Alta.
The plans for the Home for Delinquent Children, at the Altawana Subdivision, have been enlarged, and the building will now cost $12,000 instead of $6,000. Architect, J. Baley, City Hall.

Moncton, N.B.
A site at the corner of St. George and Lutz Sts., has been purchased for the erection of a church for the Parish of L'Assomption. Funds are now being raised for the building. R. A. Frechet is the architect.

Montreal, Que.
D. G. Loomis, 1112 St. Patrick, who has the general contract for the new R. C. School on Ottawa St., will receive prices on structural steel, electrical, plumbing, roofing, architectural iron, marble and tile work.

Montreal, Que., Notre Dame de Grace
New tenders on the erection of a college building on Sherbrooke St., for Loyola College are invited by Peden & McLaren, architects, 20 St. Alexis St., Montreal, until April 17th; estimated cost $400,000.

Montreal, Que., Rockfield
Plans are being drawn for a school building for the School Commrs. of Coteau St. Pierre by Peden & McLaren, architects, 20 St. Alexis St., Montreal, who are inviting tenders; estimated cost $200,000.

Montreal Que. (Pt. aux Trembles)
C. A. Reeves, architect, 58 St. James St., Montreal, will receive tenders until April 16th for the erection of a school building for the R. C. Commission.

Montreal West, Que.
Tenders for [illegible] the erection of a fire and police station, on Westminster Ave., are invited by the Town Engineer, who will also receive tenders for heating and plumbing, until [illegible]

North Augusta, Ont.
[illegible] the tenders received for the erection of the school were too high, the plans are being altered for a smaller building. Architect, B. Dillon, King St., Brockville.

Ottawa, Ont.
The erection of a Sunday School is proposed by the First Congregational Church, [illegible]

Plans for the erection of an abattoir, on [illegible] Ave., have been drawn and approved by the Board of Control. R. Percy Sims, 146 Lemoine St., is the architect, and the estimated cost is $100,000.

Painswick, Ont.
At a special meeting of the St. Paul's Church Congregation is was decided to proceed at once with the building of a new church to replace the one destroyed by fire. The following Bldg. Com. was appointed: A. Purvis, Geo. Webb, W. J. Leonard, Selby Carr, Geo. Hewson and Rector.

Prince Rupert, B.C.
Plans for the erection of a court house, etc., at a cost of $150,000, have been prepared and approved, and tenders will shortly be called by the Public Works Dept. Architect, A. A. Cox, Carter-Cotton Bldg., Vancouver.

Quebec, Que.
Plans are being prepared by Mr. R. P. Lemay, architect of 19 d'Aiguillon St., for a church for the Redemptorists Fathers. Rev. J. Wood, 7 St. Stanislas St., will give further information.

Redcliff, Alta.
The erection of 3 schools, at a cost of $12,000, is proposed by the Redcliff School Board. Further information can be obtained from the Mayor.

Regina, Sask.
Plans for alterations to the city hall are being drawn by O. T. Falls, architect, Building Inspector. The proposal is to alter the Council Chamber into a General Offices and the Police Court into a Council Chamber.

A by-law is to be voted on April 23rd for the purchase of a site on the north side, for the erection of a collegiate institute. Estimated cost $36,000.

Plans for the erection of a nurses' home, on 14th Ave., at a cost of $75,000, are being drawn by Reilly, Dawson & Reilly, Westmann Chambers.

A by-law is to be voted on April 23rd to raise $12,000 for an entrance to Exhibition grounds (including installation of ticket wickets and turnstiles, and also for equipping the Fair building).

Saskatoon, Sask.
The erection of an abattoir is proposed by the Saskatchewan Co-operative Abattoir & Cold Storage Co., Ltd.

Tenders for the erection of a students residence, connected with the Saskatchewan University, will be received by the Board of Governors up to April 20.

The Saskatchewan Legislative Assembly has granted the sum of $250,000 for the construction of new buildings for the university, and plans are being prepared by Brown & Vallance, 3rd and 12th Sts., for physics and chemistry buildings.

A site for the erection of the armoury has been secured at the corner of Spadina Cres. and 3rd Ave.

The plans for the post office on 4th Ave and 23rd St., have been completed, and work on the building will be started this year.

Sorel, Que.
Tenders for post office fittings will be received by R. C. Desrichers, Secretary, Public Works Department, [illegible] until 4 p.m., April 20th. Plans, etc., are at

office of R. L. Deschamps, Overseer of Public Buildings, Post Office, Montreal, Postmaster, Sorel, and at the Department, Ottawa.
Ottawa.

Strathroy, Ont.
Additions and alterations and the installation of new heating and plumbing to Colborne St. school, are proposed by the School Board.

Sussex, N.B.
It is understood that the question of the erection of an agricultural college and drill hall has been shelved indefinitely.

St. John, N.B.
The county council has decided to build a new hospital instead of making an addition. The government has authorized the council to issue bonds, and plans are being drawn by H. C. Mott, architect, 13 Germain St. The cost of the building is estimated at $300,000.

Toronto, Ont., Fairbank
The Fairbank School Board have under consideration an addition of 4 rooms to the public school. Architects, Lindsay & Brydon, Trinity Sq., Toronto.

Toronto, Ont.
The Supt. of Buildings will start at once on the rebuilding of Lansdowne School by day labor.

Tenders for the erection of a R. C. Church on Dufferin street for the Italian community, will be received by A. W. Holmes, architect, 10 Bloor St. E., until April 11th.

Toronto, Ont. (Weston)
A site with 50 ft. frontage on Main St. has been purchased by the Board of Trustees of the Local Masonic Lodge for the erection of a temple.

Union Bay, B.C.
Tenders for interior fittings at the post office will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. April 27. Plans and specifications are at the office of Mr. Wm. Henderson, Res. Architect, Victoria, Postmaster, Union Bay, and at Dept., Ottawa. Specifications are also at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Welland, Ont.
The town council has appointed a committee to secure options on sites suitable for the erection of the proposed public library.

Weyburn, Sask.
Tenders will be received up to April 11th by Geo. J. G. Jarrett, architect, Fox Block, for the construction of a 4-room addition to the Souris School. The estimated cost is $25,000.

Wolfville, N.S.
Plans for a college residence in connection with the Acadia University are being drawn by Chas. H. McClure, 649 Massachusetts Ave., Cambridge, Mass. The building is to accommodate 40 to 60 lady students.

CONTRACTS AWARDED

Algoma Dist., Ont.
The contract for the erection of the House of Refuge has been awarded to McPhail & Wright Constr. Co., Gouin St., Sault Ste. Marie.

Bancroft, Ont.
The contract for the erection of a school for the School Board has been secured by Norman McLean, Bancroft.

Essex, Ont.
The library contract has been awarded to Johnson & Rogers.

Fredericton, N.B.
The sub-contract for plumbing at the Normal School Annex has been let to A. H. Farrell, Queen Street.

Hamilton, Ont.
The contract for the Y. W. C. A. buildings, on Main St. W., has been let to H. G. Christman & Co., Main and Hughson Sts. Seven storeys, 70 x 45, pressed brick and steel construction. Architects, Mills & Hutton, 804 Bank of Hamilton Bldg.

Lindsay, Ont.
The contract for alterations to the post office has been let by the Public Works Dept. to Jas. Boque, 220 Dublin St., Peterborough, Ont.

Montreal, Que.
The contract for the erection of the R. C. School on Ottawa St., has been awarded to D. G. Loomis, 1112 St. Patrick St. Architect, W. E. Doran, 189 Bleury St.

The following sub-contracts have been awarded on the erection of the Ottawa St. R. C. School: ventilating, heating & vacuum cleaning systems, Thos. O'Connell, Ottawa Street, temperature regulators, National Regulator Co., 502 New Birks Bldg.

The following contracts on the alterations to the Esplanade School have been let. Heating and plumbing, W. J. McGuire & Co., 322 Craig W.; electrical, W. O'Leary & Co., 36 Recollet St.; Anglins, Ltd., 65 Victoria St., are the general contractors. Architects, Nobbs & Hyde, 49 Beaver Hall Hill.

Montreal, Que. (Maisonneuve)
The sub-contract for painting the market has been let to A. Clerbois, Maisonneuve, price $1,225.

Ottawa, Ont.
The contract for the erection of a dormitory, etc., on Division St., has been awarded to St. George & Son, Division St. Architect, J. G. Pigeon, 193 Waller street.

Pembroke, Ont.
The library contract has been awarded by the town council to Kehoe Bros., Pembroke; the contract for fittings is not yet let. Architect, F. C. Sullivan, Castle Bldg., Ottawa.

Quebec, Que.
The following contracts have been awarded in connection with the erection of a school, for the Bon Pasteur Convent, St. Amable St. General contractor and masonry, Ed. M. Belanger, Beauport, Que.; roofing, Eug. Falardeau, 308 Dorchester St.; painting, Gauthier Co., 292 St. Joseph St. The carpentry, heating, plumbing and electrical will be done by day labor. Architects, Tanguay & Lebon, 20½ D'Aiguillon St.

St. Cyrille de l'Islet, Que.
The contract for the erection of the Roman Catholic Church has been awarded to Jos. St. Hilaire, St. Romuald, Que.

Wolfville, N.S.
The contract for the erection of the Presbyterian Church, on Main St., has been let to C. H. Wright, 2 Smith St., Halifax.

Business Buildings and Industrial Plants

Alliston, Ont.
The Dominion Gas Tractor Co. who propose to build a plant here shortly, will manufacture gas tractors for the western market.

Barrie, Ont.
The erection of a drug store on Essa St., at a cost of $7,000, is being considered by A. E. Patterson, Druggist, Allandale.

Brampton, Ont.
The Copeland, Chatterson Co. propose to enlarge their factory, at a cost of $50,000, and install addition equipment to the value of $30,000. A by-law granting certain exemptions to the company is to be submitted to the ratepayers.

A by-law guaranteeing the bonds of Lindners, Ltd., to the extent of $20,000 for the erection of a factory is to be voted on shortly.

Calgary, Alta.
Plans for the erection of a 6-storey warehouse, on 11th Ave., for the Gutta Percha & Rubber, Ltd., are being prepared; estimated cost $50,000.

Canora, Sask.
A. D. Hilts, of Glenwood, Minn., U.S.A., has offered to move his plant from Minnesota to Canora, with all modern machinery. The town will grant a site including a building 90 x 40 erected thereon. The proect will involve the outlay of about $10,000.

Didsbury, Alta.
Tenders for the erection of a $40,000 hotel are about to be called by J. E. Burrill, architect, 601 Centre St., Calgary.

Edmonton, Alta.
The erection of a factory for the manufacture of moving picture films is contemplated by Mr. Aylesworth, of the Lyceum Theatre. A Stock Co. will be formed for the purpose.

Fort Erie, Ont.
The erection of an auto factory is proposed by the Johnston Motor Car Co., who have secured options on suitable sites.

Fullarton Twp., Ont.
The construction of farm buildings, at a cost of $5,000, is contemplated by Richard Nethercott, of Mitchell.

Hamilton, Ont.
The McGregor Shirt Co., 19 Hughson St. S., propose to erect a 3-storey factory on Margaret St., at a cost of $13,000.

Landy Bay Reserve, Sask.
Tenders for the erection of farm buildings will be received by J. D. McLean, Sec. Dept. of Indian Affairs, Ottawa, until April 27th. Plans, etc., are at the Dominion Lands Office, Prince Albert, Duck Lake, Sask., with Thos.

Borthwick, Mistawasis, Sask., and at the Dept., Ottawa.

Lindsay, Ont.

A by-law granting $7,500 and fixed assessment to Horne Bros. Woolen Mills, has been passed. New buildings are to be erected and a new plant equipped.

London, Ont.

The construction of an elevator is proposed by the Hunts Milling Co., Ridout St. The contract will be let to one firm who will plan and construct, etc.

Plans for the erection of an arena for W. R. Vining, are being drawn by Jno. M. Moore, architect, 435½ Richmond St.

The erection of a grand stand of steel and concrete construction is proposed by the London Baseball Club. Further information can be had from S. Stevely, Richmond St., or Dr. H. T. Reason, 632 Elias St.

McGregor, Ont.

H. J. Heintz Co., Ltd., of Leamington, propose to erect a salting station, at a cost of $7,000.

Medicine Hat, Alta.

The Tabor Candy Co., Ltd., are about to erect a factory at a cost of $25,000. The plans are being drawn by Bourne & Morrison, architects.

It is understood that Fry's, Ltd., of Bristol, Eng., have abandoned the idea of erecting a plant here.

Montreal, Que.

Plans for a 6-storey addition to the premises of W. H. Scroggie, Ltd., St. Catherine and Bleury Sts., are being drawn by D. J. Spence, Beaver Hall Hill.

The erection of a storage warehouse on St. Henry St. is being considered by the Imperial Tobacco Co. of Canada, Ltd., 900 St. Antoine St. Estimated cost $10,000.

S. Vineberg, 316 Notre Dame W., is still receiving tenders for reinforced concrete, plastering, plumbing, heating, electrical and roofing, in connection with the erection of a theatre on St. Lawrence and Duluth streets.

Sub tenders for carpentry and roofing in connection with the erection of the Belding Paul Corticelli, Ltd., office building, on Shearer St., are invited by the general contractors, Anglins, Ltd., 65 Victoria St.

Orillia, Ont.

A by-law granting a loan of $50,000 to J. R. Eaton & Sons, Ltd., has been carried by the ratepayers. The company will erect a woodworking factory at a cost of $100,000.

Ottawa, Ont.

Plans for a theatre on [illegible] for A. E. Sharron, are being drawn by J. C. Sullivan, Castle Bldg. [illegible] Estimated cost $35,000.

The erection of a [illegible] stables, etc., on Catherine and Elgin Sts., is being considered by the Central Canada Horse [illegible]. [illegible], 2nd Ave., is the architect; estimated cost $40,000.

Plans for the erection of a branch bank at the corner of Rideau and Waller Sts., are being drawn for the Bank of Ottawa, by J. P. MacLaren, architect, 101 Sparks St. Tenders will be called shortly.

Peterboro, Ont.

Plans for the erection of 6 stores and apartments are being drawn for J. T. & R. C. Braund. A site has been purchased on Charlotte street.

Port Coquitlam, B.C.

The B.C. Steel Corporation has secured a site and will erect a plant for the manufacture of all kinds of structural steel.

Quebec, Que.

Plans for the erection of a shoe factory for Tourigny & Marois are being drawn by R. L. Lemay, architect, 10 d'Aiguillon Street.

Regina, Sask.

Plans for the erection of an office building, on 12th Ave., are being prepared for the Sask. Elevator Co., Leader Bldg., Hamilton St., by Storey & Van Egmond, 1013-14 McCallum Hill Bldg.

The erection of a theatre, on Rose St., at a cost of $25,000, is proposed by D. M. Hackney, 1817 Scarth St. Architect, S. J. Tripp, 509 Canada Life Bldg.

Rodney, Ont.

The erection of farm buildings, at a cost of $6,000, is being considered by ex-Warden, Wm. Tolmie.

Sarnia, Ont.

Plans for stores and apartments, on Christina St., are being drawn for M. Baty, by R. W. Soper, 151 North Vidal St. The estimated cost is $7,000.

Saskatoon, Sask.

The Canadian City & Town Properties, Ltd., of Winnipeg, have under consideration the erection of a $200,000 business block, at the corner of 2nd Ave. and 23rd street.

Shaunavon, Sask.

A permit for the erection of a $20,000 hotel has been granted to J. Kennedy by the Provincial License Commission.

Speedsville, Ont.

The Christie Lime Co. intend making a 3-storey addition to their factory. Machinery will be required for producing fine grades of ground lime.

Strathroy, Ont.

The building of a new printing office, at a cost of $15,000, is proposed by Mr. D. Evans, of The Strathroy Age.

Toronto, Ont.

The Tip-Top Tailoring Co., of 245 Yonge St., are having plans drawn for a 5-storey warehouse on Richmond St. Architect, I. Feldman, 44 Adelaide St. W.

Tenders for the erection of theatre, lodge room and assembly hall, on St. Clair and Elmwood Aves., are invited by L. Foulds, architect, 21 Leader Lane.

Winnipeg, Man.

[illegible] the Public Press, Ltd., 275 Sherbrooke St., are being drawn. Tenders will be [illegible]

[illegible]

CONTRACTS AWARDED

Barrie, Ont.

The following contracts have been awarded in connection with the erection of the Dunlop St. branch of the Bank of Toronto. General contractor and mason, A. E. Stapleton, Wellington street; carpentry, The Ball Planing Mill Co., Ltd.; plastering, C. E. Partridge; painting, Wm. Shouldice; heating and plumbing, J. R. Hambly, Dunlop St.; electrical, Electric Light Commsn. Architect, C. F. Martin, 95 King St. E., Toronto.

Halifax, N.S.

The contract for extension to the Maritime Telegraph & Telephone Co. Bldg., Hollis St., has been awarded to S. Marshall & Son, Keith Bldg., Barrington St. Architect, H. E. Gates, Dennis Bldg.

Kentville, N.S.

The contract for the erection of a business block for T. P. Calkin, has been secured by Harry R. Best.

McBride, B.C.

The contract for the erection of the new hotel has been secured by Doyle, Thomas & Christensen, Ltd., 2nd St., Edmonton.

Montreal, Que.

The contract for alterations to the stores of Keucel & Esser has been let to Murray & McRitchie, 216 Coristine Bldg.

The contract for the erection of the office building for the Belding Paul Corticelli Ltd., 185 Shearer St., has been secured by Anglins Ltd., 65 Victoria St.

The contract for the erection of one store and 2 flats, on Notre Dame W., for R. Pernes, has been let to S. Berlin, 38 Mozart.

The contract for the erection of stores and residences, on St. Denis St., for A. Letondal, 317 Mackay St., has been let to Bisson Freres, 64 Rivard St.

The contract for the erection of the office building, at 307 St. James, has been awarded to Anglins, Ltd., 65 Victoria. Architects, Barott, Blackader & Webster, New Birks Bldg.

Ottawa, Ont.

A contract for the erection of stables, on Albert St., has been let by Nap. Lafrenierre, 41 Spruce St., to W. F. Slack, Flora St.

Prince George, B.C.

The contract for the erection of the new hotel has been secured by Brewster & Pelham, Prince George, who in- [illegible]

Saskatoon, Sask.

The contracts for the erection of the branch bank, on 2nd Ave., for the Bank of Nova Scotia, has been let to Bigelow Bros., 155 2nd Ave. S.

Toronto, Ont.

The following contracts have been awarded in connection with the erection of the office and warehouse, one wing, for H. Greisman: masonry, Albert Webb, 13 Shirley Ave.; carpentry, J. A Simon, [illegible] Yonge St.; [illegible] & [illegible]er, Vanhorne St.; steel sash, Trussed Concrete Steel Co., 23 Jordan St.; wiring, [illegible] Ave.; painting, F. G. Roberts & Co., Wells St.

Residences

Alvinston, Ont.

The erection of a [illegible]

(Continued on page [illegible])

Tenders and For Sale Department

Church Tenders

Sealed tenders addressed to the undersigned will be received until the afternoon of **Wednesday, April 15, 1914**, for the erection of a new Lutheran Church in the town of Hanover, Grey County, Ontario.

Plans and specifications will be on view at the office of the Collector of Customs.

The lowest or any tender not necessarily accepted.

D. WEPPLER,
Secretary-Treasurer.
Hanover, March 28th, 1914. 13-14

CITY OF REGINA

Waterworks Dept.

Sealed tenders will be received by the City Commissioners up till noon, **Wednesday, April 22nd, 1914**, for the supply and delivery, freight and duty paid Regina, of the following:—

Contract B.—Cast Iron Pipe and Special Castings.
Contract C.—Lead Pipe, Galvanized Pipe, Jute Rope and 1-in. Black Pipe.
Contract Ca.—Pig Lead.
Contract D.—Iron Body Gate Valves, Valve Boxes and Fire Hydrants.
Contract Da.—2-in. Brass Gate Valves.
Contract E.—Brass Goods, Lead to Lead Unions, Curb Boxes.
Contract F.—Water Meters.
Contract G.—
G1 Steel Reinforcing.
G2 Portland Cement.
G3 Steel Pipe or Alternative.

Specifications and other information may be obtained at the office of the undersigned.

A marked cheque for five per cent. of the bid must accompany each tender.

The City does not bind itself to accept the lowest or any tender.

J. M. MACKAY,
14-15 Supt. of Waterworks.

Corporation of the City of London, Ontario

Tenders for Sewer and Pavement Construction and Supply of Castings

Sealed tenders addressed to the "Chairman and Members of the Board of Control," will be received by the City Clerk up to 5 p.m., **Thursday, April 16th, 1914**, for the following, i.e.:

(a) Construction of 8,000 sq. yds. of asphaltic cement paving.

(b) Construction of 2,740 sq. yds. of vitrified brick paving.

(c) Construction of 1,500 lin. ft. of 8-in. sanitary tile sewer.

(d) Supply of Cast Iron Manhole covers and frames.

(e) Supply of Cast Iron Gulley grates and frames.

All particulars and conditions of tender can be obtained from the office of the City Engineer.

Copies of plans, specifications, etc., will be supplied on receipt of Ten Dollars ($10.00), which will only be returned on a bona fide tender being submitted.

The lowest or any tender not necessarily accepted.

WM. N. ASHPLANT,
City Engineer.
C. M. R. GRAHAM, Mayor. 14

CHURCH TENDERS

Sealed tenders, marked "Tender," will be received by the undersigned until 5 o'clock p.m. on **Tuesday, April 21st, 1914**, for the erection of a new Presbyterian Church in the Village of Alvinston, **Ont.**

Plans and specifications can be seen at the office of the Architect, Wm. G. Murray, Dominion Savings Building, London, Ont., or at the office of the Secretary in the Village of Alvinston, Ont.

A deposit of $500 must accompany each tender as a guarantee of good faith. The lowest or any tender not necessarily accepted.

P. A. McDIARMID,
Secretary Building Committee.
Alvinston, April 1, 1914. 14-15

Township of Burford

Whiteman's Creek Bridge

Sealed tenders, clearly endorsed on the outside "Tender for Superstructure," will be received by the Township of Burford up to noon on **Saturday, May 2nd, 1914**, for the manufacture and erection of a Class "B" steel highway bridge over Whiteman's Creek on the Side Road one mile north of the village of Burford.

Specifications and instructions to bidders may be had from Jackson & Company, Temple Building, Brantford.

Tenders should be addressed to the Township Clerk, F. W. Taylor, Esq., R. R. No. 3, Burford.

ALAN MAIR JACKSON,
14-15 Township Engineer.

CITY OF WESTMOUNT

City Engineer's Department

Tenders are invited for the following supplies for the year commencing **May 1st, 1914**:

(a) Cement.
(b) Sand.
(c) Quarried Stone.
(d) Crushed Stone.
(e) Paving Blocks.
(f) Sewer Pipes.
(g) Bricks.
(h) Farm Tile.
(i) Coal.
(j) Dust Layers and Road Binders.

Specifications, form of tender and other information can be obtained at the office of the City Engineer.

Sealed tenders marked "Tenders of Supplies" will be received by the Secretary-Treasurer up to twelve noon, **April 15th, 1914**.

The City Council reserves the right to reject the lowest or any tender and do not guarantee to grant an exclusive contract to any tenderer.

P. E. JARMAN,
14 Acting City Engineer.

Tenders Wanted

Tenders, separate or bulk, will be received by the undersigned until 5 p.m. on **Monday, April 13**, for a church building on Dufferin street; the lowest or any tender not necessarily accepted. Arthur W. Holmes, architect, **10** Bloor St. E. 14

CITY OF BRANTFORD

PROVINGE OF ONTARIO

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer of the Board of Water Commissioners until 8 p.m., **Thursday, April 30th, 1914**, for the following works:—

Contract "B"
FIRE PROOF PUMP HOUSE
Contract "G"
PUMPING MACHINERY

(a) Two, four million gallon Turbine Pumps and two motors to operate same for domestic service.

(b) Two, four million gallon Booster Pumps for fire service motor driven.

(c) Steam Turbine alternative for operating Booster Pumps.

Bidders may submit bulk offers for "B" and "G."

Plans and specifications may be seen at the City Hall, Brantford, or at the office of the Engineers, 204 Mail Building, Toronto.

Lowest or any tender not necessarily accepted.

JOHN FAIR, Esq., Chairman.
F. W. FRANK, Esq., Sec.-Treasurer.
CHIPMAN & POWER, Engineers.
14-15

TOWN OF WALLACEBURG

PROVINCE OF ONTARIO

Water Works and Sewerage Works

Sealed tenders will be received by the Town Clerk until 8 p.m. on **Tuesday, May 5th, 1914**, for the following works:—

Contract "A-1"—Laying Water Mains.
Contract "A-2"—Laying Sewers.
Contract "C"—Water Tower and Foundations.
Contract "D"—Water Pipes and Specials.
Contract "E"—Fire Hydrants, Gate Valves and Valve Boxes.
Contract "F"—Mechanical Pressure Filters.
Contract "I"—Intake and Basin.
Contract "M"—Laying Force Main.
Contract "S"—Furnishing Sewer Pipes.

Plans and specifications may be seen at the Engineer's office, Mail Building, Toronto, or at the Resident Engineer's office, Wallaceburg, on and after April 11th.

The lowest or any tender not necessarily accepted.

T. B. DUNDAS, Esq., Mayor.
H. E. JOHNSON, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.
14-15

Notice to Contractors

Asphalt Pavement

Sealed tenders addressed to the Chairman and Members of the Board of Control, will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Tuesday, April 14th, 1914**, for the construction of approximately 25,000 square yards of asphalt pavement and 15,600 lineal feet of concrete gutter.

Any tender received after the above stated time will be declared informal.

Specifications, form of tender and full particulars may be obtained on application to the City Engineer's office, City Hall, Ottawa.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.

Ottawa, March 1st, 1914. 14

Sealed tenders addressed to the undersigned and endorsed "Tender for Coal for Departmental Dredges, Ontario and Quebec," will be received at this office until 4 p.m., on **Monday, April 27, 1914**, for the supply of Best Quality, Steam, Anthracite and Blacksmith Coal to be delivered in quantities and at places mentioned on forms of tender.

Combined specification and form of tender can be obtained at this Department and at the offices of A. E. Dubuc, Esq., District Engineer, Shaughnessy Building, Montreal, Que.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.

Tenders will not be considered unless made upon forms furnished by the Department and in accordance with conditions contained therein.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for the amount mentioned in the tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
55671. Ottawa, April 6, 1914 14-15

TOWN OF ESTEVAN

Province of Saskatchewan

Notice to Contractors

Sealed tenders endorsed on envelope "Tender A," "Tender B," etc., as the case may be, will be received by the Secretary-treasurer until 8 p.m. on **Saturday, May 9th, 1914**, for the following works:—

Contract "A"—Laying Watermains and sewer pipes (approximately 10,500 feet of watermains and 16,000 feet sewer pipe).

Contract "D"—Furnishing cast iron water pipe and specials.

Contract "E" Furnishing fire hydrants and gate valves.

Contract "F" Furnishing sewer pipe and junctions.

Plans, specifications and forms of tender may be seen at the Town Engineer's office, Estevan, Sask., or at the office of the "Canadian Engineer," Winnipeg, on and after April 10th, 1914.

[illegible] plans, will be sent to contractor on receipt of Five ($5.00) [illegible] funded on return of such.

[illegible]

JAS. A. SMITH, Mayor,
P. J. STEPHENS, Sec.-Treasurer
[illegible]

14-15

Tenders for Cold-Storage Equipment

Toronto Civic Abattoir

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, April 28th, 1914**, for the supply and installation of Cold Storage Equipment in the Toronto Municipal Abattoir, situated on Tecumseh street.

Tenders will be received in bulk for the Ice Machine, Equipment complete, including Piping, Cork Insulation, Floors of Freezing Rooms, Cold-storage Doors and Windows, Electric Wiring, Plastering, Painting, Tracking, Conveyor, Motors, Scales, Racks for Freezers, etc.

Specifications, tender form and all information desired may be obtained upon application at the office of William R. Perrin, 530 King street east, Toronto, Ontario, or 200 Old Colony Building, Chicago, Ill.

Envelopes containing tenders must be plainly marked on the outside as to contents. Tenderers shall submit with their tenders the names of two personal sureties approved of by the City Treasurer, or in lieu of said sureties, a bond of a Guarantee Company approved as aforesaid. Each tender must be accompanied by a cash deposit or certified cheque equal to 2½ per cent. of the aggregate amount of the tender.

Conditions relating to tendering as prescribed by City By-laws must be strictly complied with, or the tenders will not be entertained. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control

City Hall, Toronto, April 3d, 1914. 14

TOWN OF LEASIDE

Tenders for Waterworks and Sewers

Sealed tenders addressed to the undersigned [illegible] Saturday, April 18, 1914, for each of the following:

Waterworks brick pump house.

[illegible] stallation.

Concrete pumping well.

Wooden collecting well, including material and labor.

Cast iron water pipe, hydrants and valves, etc.

[illegible] hydrants.

[illegible] and labor.

[illegible]

[illegible] Street East, Toronto, Ont.

[illegible] immediately after acceptance.

[illegible]

[illegible]
[illegible]
64 East King St.,
[illegible]

14

CITY OF STRATFORD

Sealed tenders will be received by the undersigned up to five o'clock p.m., **Monday, April 20th**, for the construction of:—

12,000 sq. yds. of Concrete Base for Pavements.

3,400 sq. yds. of one course Concrete Pavement.

12,650 lin. ft. of Concrete Curbing.

Specifications and forms for tender may be had from the office of the City Engineer,

A. B. MANSON,
City Engineer.

Stratford, Ont., April 2, 1914 14-15

Steam Rollers

Sealed tenders will be received up to 4 p.m. on **Monday, April 27th, 1914**, for an 8-ton Steam Roller, to be supplied to the Corporation of the City of Victoria, B.C.

Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted.

W. GALT,
City Purchasing Agent.

March 18, 1914. 12-14

Tenders for Bridge Construction

Sealed tenders, plainly marked as to contents, will be received up to noon on **Friday, May 1st, 1914**, by S. Barratt, Esq., Clerk of the Township of Etobicoke, Islington, Ont., for the construction of a concrete bridge over the Mimico Creek between Cons. III. and IV., Lot 24, Township Etobicoke, County of York, known as Avery's Bridge.

Plans, specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.

Toronto, April 8, 1914. 14

CITY OF LONDON, ONTARIO

Tenders for Sewer Construction

Sealed tenders, addressed to the City Clerk, will be received until 5 p.m. on **Thursday, May 17th, 1914**, for the construction of the following works:

Contract 1. Egerton Street Section, Storm and [illegible]

Contract 2. Adelaide Street Section, Storm Sew[illegible]

[illegible] ers only.

Contract 4. Ridout Street Section, Storm Sewers only.

[illegible] Sewers only.

[illegible] ronto, on and after April 10th, 1914.

[illegible]

[illegible]

CITY OF CALGARY

Sealed tenders addressed to the City Commissioners and marked "Tender for Sewer Pipe and Segment Blocks," will be received at the office of the City Clerk up to 5 p.m. on Thursday, April 23, 1914, for the supply and delivery, [illegible] Victoria Park, Calgary, and as required by the City from time to time of approximately 150,000 feet of sewer pipe and segment blocks, breakage guaranteed to the City of Calgary.

Particulars, information and specifications may be obtained from the office of the City Engineer, City Hall, Calgary.

A marked cheque in the amount of 5 per cent. of the total amount of bid, payable to the City of Calgary, must accompany each tender. Cheques will be returned to unsuccessful tenderers so soon as a contract has been executed.

The City reserves the right to accept or reject any or all tenders in whole or in part or to accept any bid or portion thereof as may be advantageous and to the satisfaction of the City.

J. M. MILLER,
14-15 City Clerk.

TENDERS FOR
Laying and Jointing of Water Pipes, etc.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on **Tuesday, April 14th, 1914**, for the Excavating, Laying and Jointing of Water Pipes, Valves, Hydrants and Special Castings, for the year **1914**.

Specifications and tender forms for the foregoing may be obtained upon application at the office of the Water Works Section, Department of Works, Room 9, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering, as prescribed by City by-law, must be strictly complied with, or the tenders **may** be declared informal. Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto, March 31, 1914. 14

Asphalt Plant

Sealed tenders will be received up to 4 p.m., **Thursday, April 30, 1914**, for a semi-portable asphalt plant for the Corporation of the city of Victoria, B.C. Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted. 11-15

Contractors' Outfit For Sale

Suitable for Sewer and Water Works Construction

One Parsons Trenching Machine, Concrete Mixers, pumps, trench braces and other tools, being a complete outfit.

Can be seen at Prince Albert, Sask., Canada. Information, write

HUGO & TIMS COMPANY,
14-17 Duluth, Minn.

Residences

(Continued from page 79)

of $6,000, is contemplated by Thos. Allinson.

Kingston, Ont.

The erection of a duplex residence, on Union St. W., at a cost of $8,000, is proposed by Chas. S. Litton, 81 Frontenac St.

London, Ont.

Plans for a $11,000 residence, on Wellington St., have been drawn for Mr. S. Little, by J. S. Moore, Carling and Richmond streets.

Medicine Hat, Alta.

Tenders for the erection of a residence, on Esplanade, for H. C. Yuill, have been received. The contract has not been awarded, and it is understood that Mr. Yuill contemplates erecting the building himself.

Moncton, N.B.

Plans for the erection of a parsonage for St. Bernard's Church, are being drawn by R. A. Freschet, 30 Bonicord street.

Montreal, Que.

Tenders for the erection of a residence for Mrs. Chas. M. Hayes, are invited by Robt. Findlay, architect, 10 Phillips Place.

Plans for the $1,000,000 apartment house, on Sherbrooke St., for the Montreal Agencies, Ltd., Sun Life Bldg., are being drawn by Barott, Blackader & Webster, New Birks Bldg. Tenders will probably be called shortly as the work is to start in June.

Montreal, Que., Notre Dame de Grace

Chas. Fyfe, 137 Park Ave., Montreal, is inviting tenders now for separate contracts on the erection of 12 residences, to close shortly.

Ottawa, Ont.

M. E. Davis, 202 Booth Bldg., proposes to erect several houses on Fairbairn St.

Peterboro, Ont.

Plans are being prepared for alterations to the apartments of Rupert Gliddon, Rubidge and Hunter Sts. Architect, Geo. M. Miller, 93 Yonge St., Toronto.

Regina, Sask.

Plans for the erection of a $35,000 apartment block have been drawn by S. K. Powell, 1333 15th Ave., by S. J. Tribb, architect, 509 Can. Life Bldg.

Toronto, Ont.

Plans for a detached residence, on Harvard Ave., to cost $6,000, have been drawn for C. O. Lasby, 426 W. Marion St.

Tenders for the erection of a duplex residence, on Oakmount St., are invited by S. B. Coon & Son, Ryrie Bldg., until April 15th.

Addition to the residence of Mrs. McIntyre, 213 Seaton St., are proposed, and tenders on masonry, carpentry, wiring, plastering and painting are invited. Architect, J. H. Stanford, Bloor and Ossington.

Winnipeg, Man.

Tenders for the erection of a $30,000 apartment house, for S. Johnston, are invited by the Architects, Hooper and Davis, Notre Dame Investment Bldg.

Power Plants, Electricity and Telephones

Brampton, Ont.

Tenders for the installation of an electric fire alarm system will shortly be called by the town council.

Grosse Isle, Que.

Tenders will be received by R. C. Desrochers, Sec. Public Works Dept., supply of 1—120 kv.a. 2-phase, 4-wire, 60-cycle, 2,200 volt belt driven dynamo, Ottawa, until 4 p.m. April 20th, for the 1 simple 175 B.h.p. steam engine, switchboard with necessary apparatus. Plans and specifications at offices of J. A. Tremblay, Dist. Engineer, Montmagny, Que.; Dist. Engineer, Quebec, Que.; R. L. Deschamps, Gen. Post Office, Montreal, and at Dept., Ottawa. Specifications also at office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Kindersley, Sask.

Tenders for the installation of a telephone system for the Smith Valley Telephone Co., will be received by the Sec.-Treas., J. J. Adam, P.O. Box 307, until April 15. Plans and specifications at office of Sec.-Treas. or at the Telephone Dept., Regina.

Mt. Forest, Ont.

The town council will make an application for 500 h.p. hydro equipment to be supplied from Eugenia Falls.

Ottawa, Ont.

Tenders for the installation of fire alarm boxes will be called shortly by the city council.

St. John, N.B.

Tenders for the construction of a car barn, on Wentworth St., are invited by St. John Street Rly. Co., Ltd. Architect, H. C. Mott, 13 Germain St; estimated cost $25,000.

Wolfville, N.S.

The Acadia University will shortly place an order for electric lighting equipment and metal stacks. The President, Dr. Geo. B. Cullen invites information.

CONTRACTS AWARDED

Bassano, Alta.

The contract for telephone line has been awarded by the town council to McCaugherty & Allen, Bassano, Alta.

Bridgen, Ont.

The Village Council has awarded the contract for wiring and installing the new street lighting system to Harry Smith, Petrolea, who will also instal equipment in houses.

Carleton Place, Ont.

A contract for electric wiring and fittings has been awarded by the Public Works Dept., to Garrioch & Godard Co., 11 Elgin St., Ottawa.

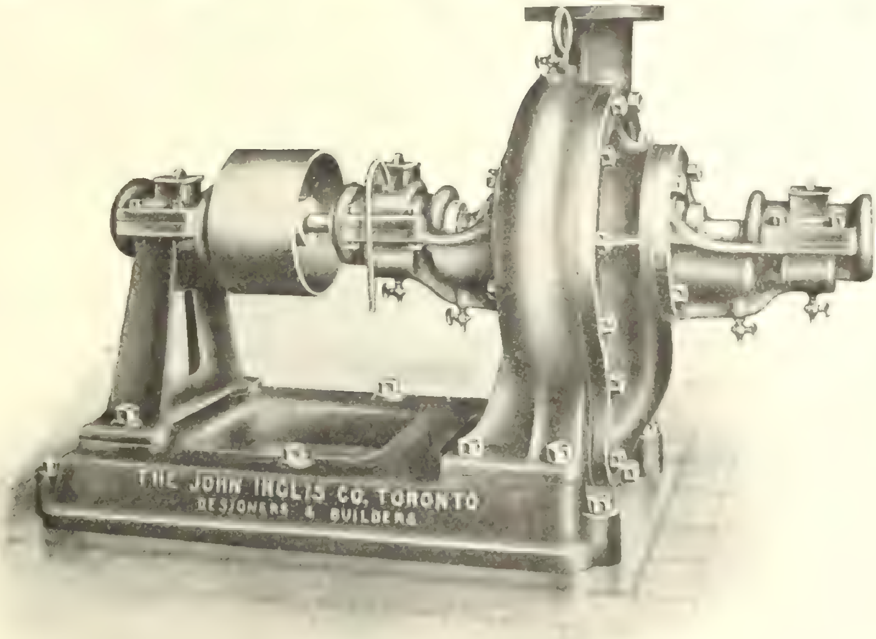
Fletts Springs, Sask.

The contract for telephone line has been awarded by the Fleet Springs Rural Telephone Co., to V. O'Brien, Room 20, Black Block, Regina.

Medicine Hat, Alta.

The contract for electric wiring has been awarded by the city council to Medicine Hat Light & Supply Co., Empress Theatre Bldg.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

STEEL PIPES

Seamless or lapwelded, mild steel, 2″ in diameter and up, long lengths.

"INDUSTRY" Bell and Spigot steel pipes for water or gas.

These pipes are asphalt coated inside and out, wrapped with specially prepared Jute, insuring protection against corrosion, and long life.

SPECIALS for "INDUSTRY" pipes either of steel or cast iron.

HIGH PRESSURE steel pipes for PENSTOCKS, FLUMES, NATURAL GAS, AIR or OIL.

All pipes tested by hydraulic pressure before shipment from the works.

Manufactured by the **GELSENKIRCHEN MINING and STEEL CO., GERMANY,**— One of the largest steel plants in Germany—employing 50,000 men.

Canadian Sales Agents

STEFFENS & NOLLE, Limited

137 McGill Street, Montreal

Boiler Tubes, Superheater and Stay Tubes

Every Engineer

Electrical News

Generation, Transmission and Application of Electricity

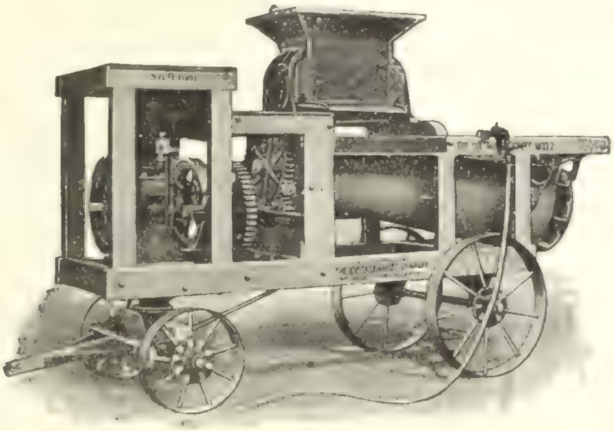
should read the Electrical News. Twice a month it tells of the latest development in connection with electrical power plants and new apparatus. It contains illustrated descriptions of big installations in every part of Canada. It tells of ways and means to improve your plant and to effect savings in operating costs. In short, it is full of information which is helpful to every engineer operating a plant in which electricity is used.

Sample copy for the asking.

Published Semi-monthly
$2.00 per year.

ELECTRICAL NEWS
220 King Street West
TORONTO

"I Have Used a Coltrin No. 9 Mixer Over Four Years My Repair Bill Has Been About $15.00"



No. 9 Coltrin Mixer

S. B. LEACH
CONCRETE CONSTRUCTION

The Knickerbocker Co.,
Jackson, Mich.

Lemoyne, Pa., Jan. 29, 1914

Gentlemen:

I have used a Coltrin No. 9 Mixer over four years. It has worked perfectly satisfactory in every way, and I consider it the best machine on the market for sidewalk and other construction where a portable machine is required. My repair bill in four years has been about $15.00. This machine has been almost constantly in use during the working season. This season we overhauled it and now it runs like a new one.

Yours respectfully,
(Signed) S. B. LEACH.

Study the Mixing Method

Which has gained such a remarkable reputation of producing uniformly good concrete at a minimum cost for

The Coltrin Continuous-Batch Mixer

Shipped anywhere on trial

For Sale by Bournival & Co., 333 Notre Dame St. East, Montreal, Que.

The Knickerbocker Co., Jackson, Mich.

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.

Sole Licencees for Canada

613 Vancouver Block,
VANCOUVER
B. C.

Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.

Office of Dominion Iron & Steel Co., Ltd
Built of Sydney Pressed Brick

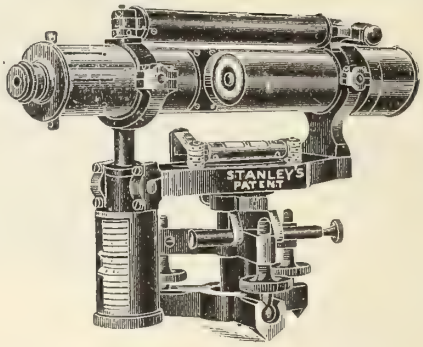
IN this product you get a brick of such superior quality that a saving of one dollar a thousand can be effected in the laying of the bricks as compared with ordinary irregular brick.

The mortar adheres with great strength to "Sydney" pressed brick and they harden with age.

Prices and Particulars on request.

Sydney Pressed Brick Co.
Limited
Sydney, Nova Scotia

TRADE **STANLEY** MARK



Stanley's Gradiometer saves much time in Railway and Drainage Works. Can be divided to read either ordinary or percentage gradients. Illustrated pamphlet on application.

The Largest Manufacturers of Surveying and Drawing Instruments in the World.

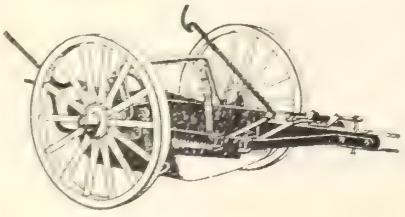
Drawing Office Stationery of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our catalogue "K 91" and compare our prices with those of other *first-class* makers.

We were awarded four Grand Prix and a Gold Medal at the Turin Exhibition, 1911.

W. F. Stanley & Co., Limited
Great Turnstile, Holborn, LONDON, ENGLAND

The Meaford Wheelbarrow Co. Limited
Meaford, Ontario, Canada



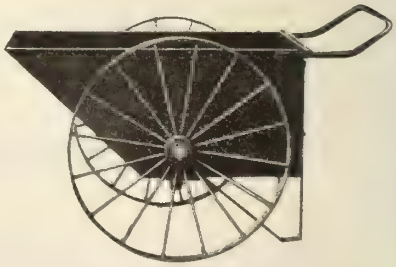
WHEEL SCRAPERS

in both Pressed Bowl and Square Box styles —

No. 2 Capacity 13 cubic ft.
No. 3 Capacity 17 cubic ft.

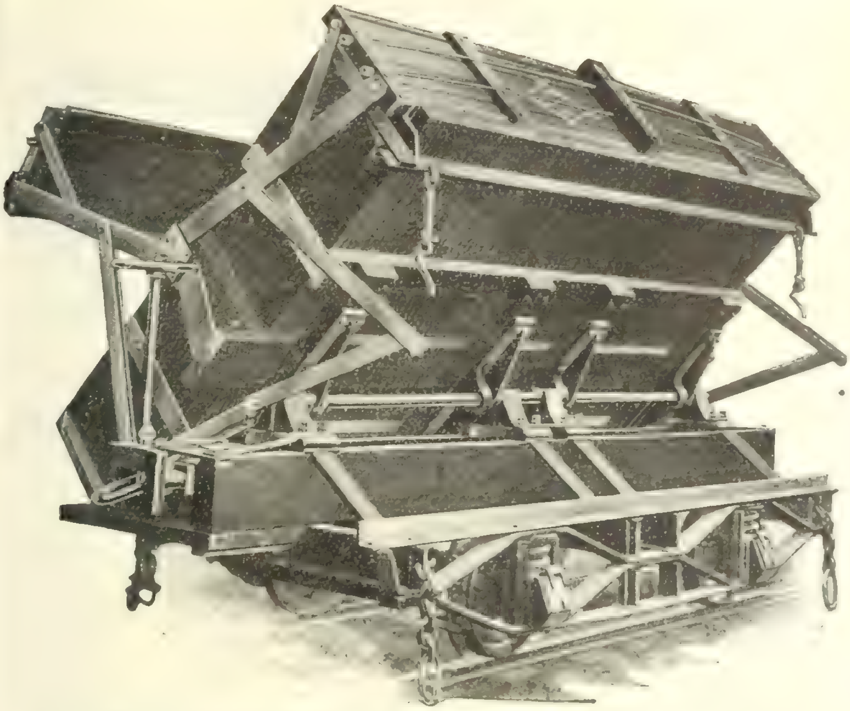
PRESSED STEEL DRAG SCRAPERS

with handles on top or sides. Four sizes— Nos. 0-1-2-3.



STERLING CONCRETE CARTS

with self-lubricating wheels. Five sizes—Nos. 0-1-2-3 and 4.



Cut showing 4 and 6 yard Double Diamond Steel Frame Car in dumped position. Full 45 degrees. Door opens away from load.

Last week we began this series showing why our cars deserve your attention and enquiry. Look it up. Keep posted. WRITE NOW.

GLENGARRY

You Want a Steel Frame Car to Have Long Life

This new steel frame car will not disappoint. It is built for hard use and lots of it. STUDY THE CONSTRUCTION. Note the under frame support of box. This box cannot sag down. See the bracing of box ends and doors! The drawbars are bolted clear through to "I" beam girts. The diamond frame is the stiffest possible. Note angle on top instead of flat iron bar. The bracing and trussing of these cars is excellent. Arch braces are trussed across drawbars distributing load on trucks in proper form. You could not build a better car!

Watch next week's issue!

The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

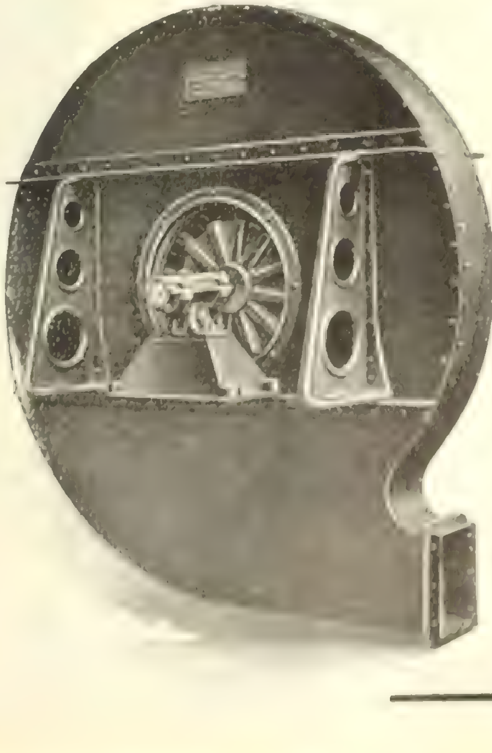
---

Your Cupola — Are You Giving it a Fair Chance?

Is it assisted by a Blower that provides for perfect combustion of the fuel?
Does it produce sufficient pressure to overcome the resistance within the cupola?

"Sirocco" Special Steel Pressure Blowers

TRADE MARK



[illegible] There are no frictional surfaces to "eat up" power in a "Sirocco" Blower. The bearings are self-aligning and self-oiling. [illegible] prevents vibration. The speeds of "Sirocco" Blowers are adaptable to direct connection to electric motors and steam turbines, thereby eliminating the usual belt and gear power losses.

Every ounce of energy put into a "Sirocco" Special Steel Pressure Blower goes to propelling air.

Write for Bulletin No. 8. It contains helpful information on Pressure Blowers

CANADIAN SIROCCO COMPANY
LIMITED
WINDSOR, ONTARIO

Sales Engineers

[illegible] [illegible] Bldg., Montreal	E. C. POWERS [illegible] Toronto	[illegible] [illegible] Winnipeg	[illegible] [illegible] [illegible]

Residence of Bishop Hoban, Scranton, Pa.. Owen McGlynn, Architect.

For Beautiful Effects;
For Mechanical Excellence;
For Distinctive and Lasting
Color, *be sure to specify either*

"BRADFORD REDS"
or
"Bradford Ruffs"

For 20 Years
THE STANDARD RED BRICK
OF AMERICA

"BRADFORD REDS"—the smooth brick. Made both dry-press and wire-cut impervious. Carefully sorted for shade and size. Ornamentals in stock.

"Bradford Ruffs"—the rough texture brick for Bungalows, Garden Walls, Grill Rooms, Fire Places, and other Rustic Effects.

Write for "RED" Catalog

Bradford Pressed Brick Co.
The "RED BRICK PEOPLE," Bradford, Pa.

We also make Fireproofing, Hollow Brick and Hollow Block.

CANADIAN AGENTS:
DARTNELL LIMITED, Montreal
SCOTT, HAMMOND & PRATT, Toronto

PRESSED
"BRADFORD
BRICK"

CRANES MADE IN CANADA

NORTHERN CRANES

All types of Good Cranes, Electric and Air Hoists

NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO

Dietrich LIMITED

Contracting Engineers

for the installation of Underground Conduits and Electrical Transmission lines.

Consult us about yours.

Dietrich LIMITED

300 Read Bldg.
Montreal

RAILS New and Relaying
Switches, Turntables, Etc.

Carried in Stock

Locomotives and Cars

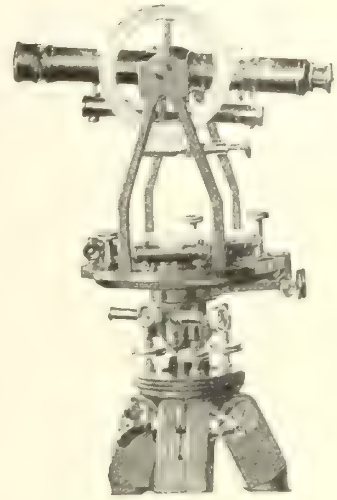
Jno. J. Gartshore, Toronto

In response to a demand

for a very light transit for rapid work, we introduced in 1887

The Gurley Reconnoissance Transit

Its continued popularity is due to its medium weight (about 7¾ lbs.), its reliability for a variety of uses and its reasonable price.



No. 100
Reconnoissance Transit
Price complete, $115.00
Including Extension Tripod
F. O. B. Troy or Seattle

Write for catalog. It tells all about Gurley Instruments for Civil Engineers and Surveyors, Highway Engineers, Contractors and Builders.

W. & L. E. Gurley, Troy, N.Y.

Makers of Engineers Instruments Since 1845

Branch Factory - Seattle, Washington

New Code Rubber Covered Wires AND Cables

Manufactured in accordance with specifications of the National Board of Fire Underwriters.

All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

Price list and discounts on application to head office or nearest agent.

Canada Wire & Cable Co., Limited

1160-1170 Dundas Street
Toronto Canada

Sales Offices

[illegible] Lake of the Woods Bldg., Montreal, Que.
A. E. Esling, 150 Princess St., Winnipeg, Man.
Macdonald, Marpole Co., Ltd., 427 Seymour St., Vancouver, B.C.

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We Manufacture a Full Line of Reliable Bricks

Comprising

RED PRESSED BRICK
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RED RUFFESTRY BRICK
FLASHED PRESSED "
FUSED PRESSED BRICK

Write us for Samples and Prices

Russell Shale Bricks, Ltd.
RUSSELL - ONT.

MACHINERY FOR SALE

1—1 yd. Smith Concrete Mixer
1—½ yd. Smith Concrete Mixer
[illegible]—12 h.p. Portable Boiler and Engine
[illegible] Steel Skips
[illegible] Steam Rock Drills
4 General Service Duplex Steam Pumps
[illegible] Vertical Boilers 4 to 25 h.p.
[illegible] Steam Pile Hammer
[illegible] Extra Heavy 2-yd. Dump Wagons
2—[illegible] Lidgerwood D.C. & D.D. Hoisting Engines
[illegible] Centrifugal Pumps
[illegible] yd. two-way 36 in. gauge Dump Cars
[illegible] Derricks & Derrick Irons
1—3 ton Motor Truck
[illegible] Water Wheels, various sizes and makes

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By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving **would have enriched your treasury approximately a** quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

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Contract Record
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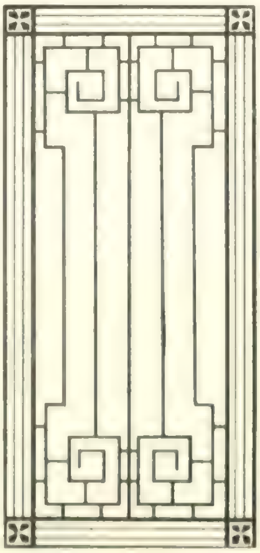

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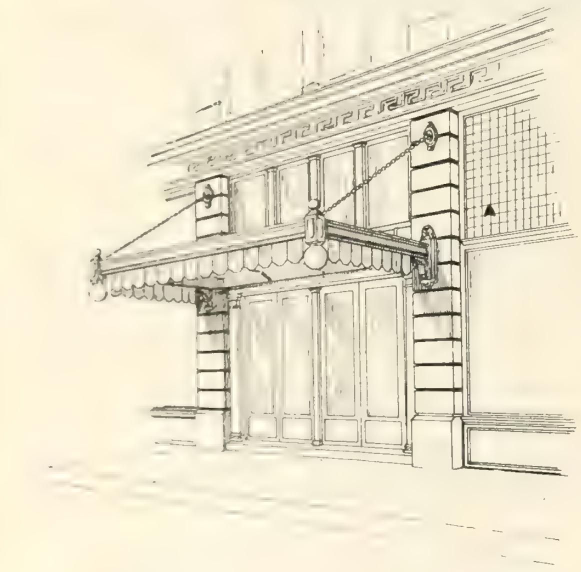

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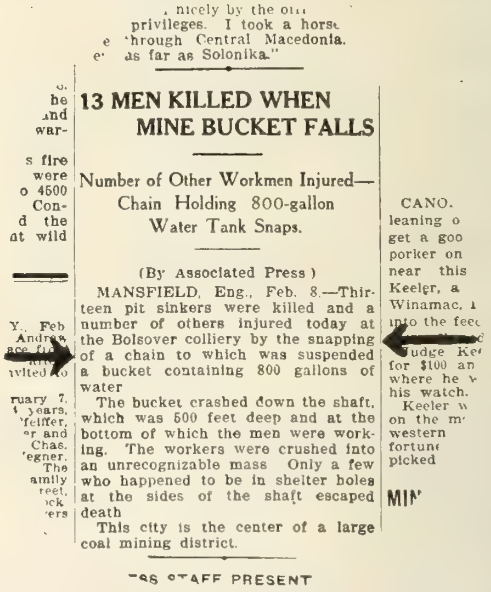

nicely by the old privileges. I took a horse through Central Macedonia, as far as Solonika."

13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

(By Associated Press)

MANSFIELD, Eng., Feb. 8.—Thirteen pit sinkers were killed and a number of others injured today at the Bolsover colliery by the snapping of a chain to which was suspended a bucket containing 800 gallons of water

The bucket crashed down the shaft, which was 500 feet deep and at the bottom of which the men were working. The workers were crushed into an unrecognizable mass Only a few who happened to be in shelter holes at the sides of the shaft escaped death

This city is the center of a large coal mining district.

Save money as well as loss of life and property by using a Canadian made electric-welded chain.

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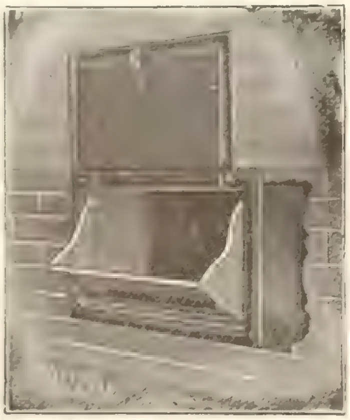

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

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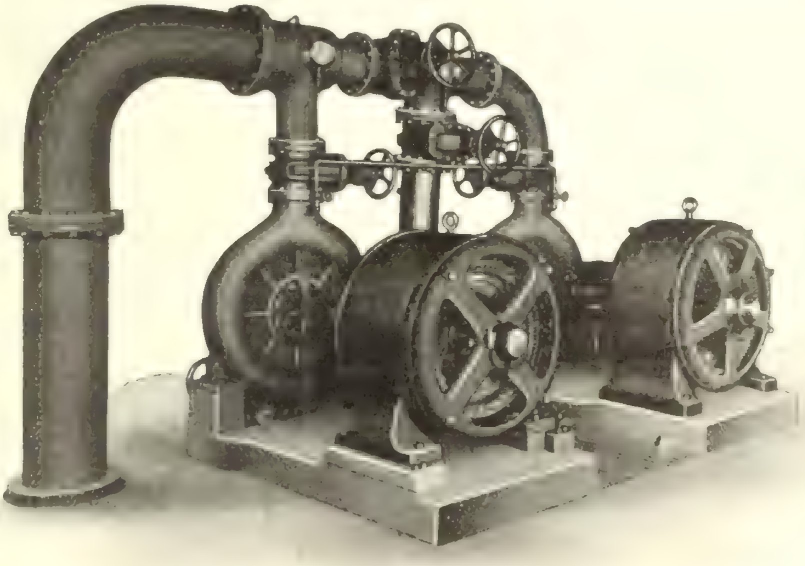

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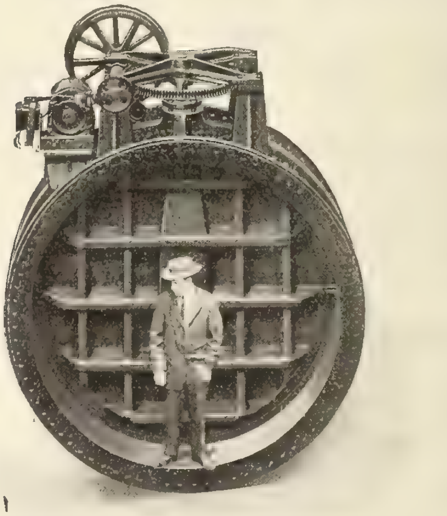

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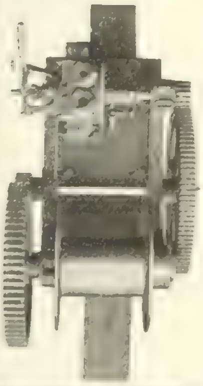

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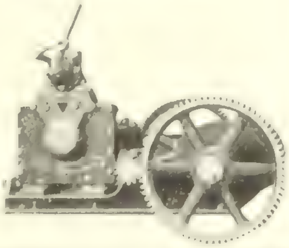

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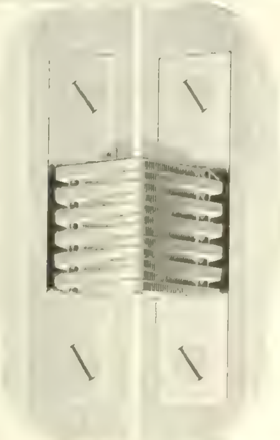

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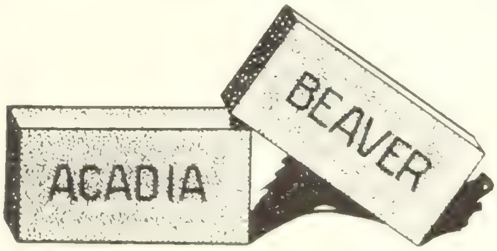

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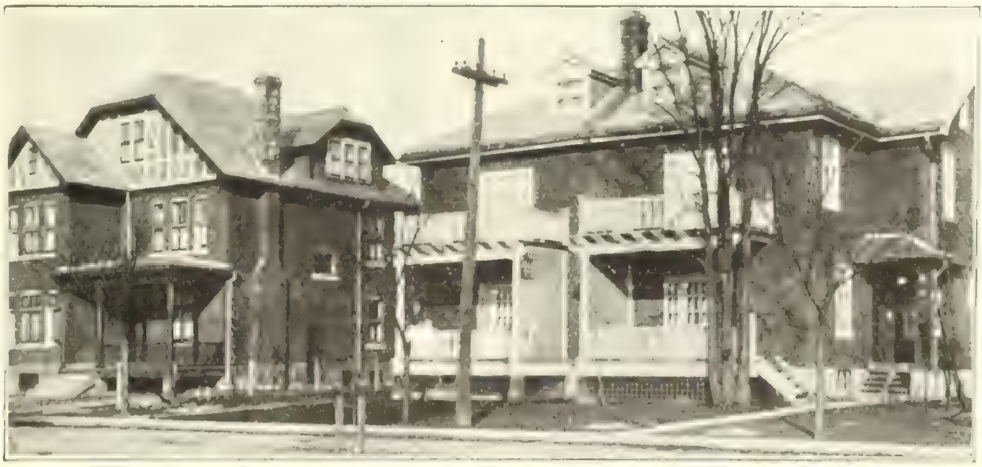

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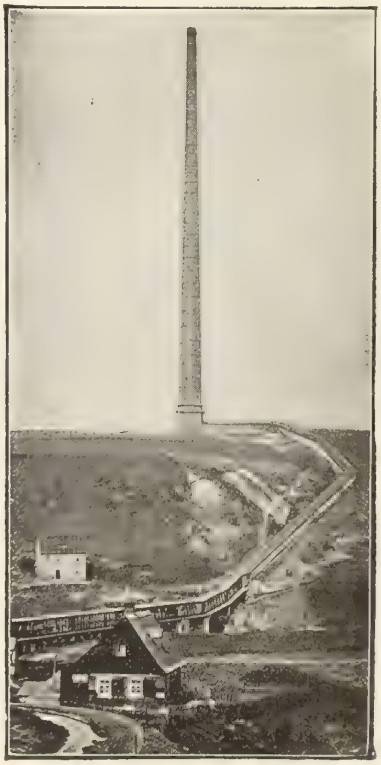

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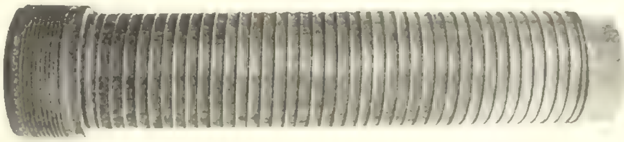

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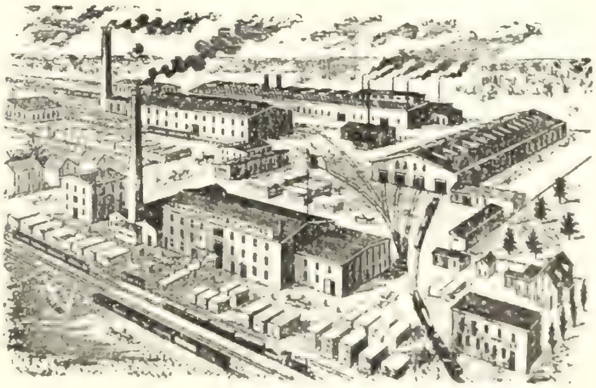

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West Kildonan, Man., municipal council has provided for the laying of sewers and water mains from McPhillip street to the Red River, the cost being approximately $22,000.

Several years ago a scheme was advocated and is again revived, to construct a bridge across the gorge at Niagara Falls, N.Y., below the falls and close to the foot of Niagara Street.

Winnipeg council has entered into an agreement with the municipality of Kildonan whereby the Jefferson Avenue sewer, 11 ft. in diameter, will be built jointly by the two cities; estimated to cost over $200,000. Mr. H. N. Ruttan is the city engineer.

The contract for one hundred miles of construction work on the Pacific Great Eastern Railway between Kelly Lake and Fort George, has been let to Messrs. H. E. Carleton & Company; A. E. Friffin & Company; and Burns, Jordan & Company, whose headquarters are at Fort George, B.C.

Westinghouse, Church, Kerr & Company, of Montreal and New York, have been retained by the Canadian Pacific Railway as engineers to investigate the proposed electrification of the new double-track, 5½-mile Selkirk Tunnel in British Columbia. The investigations will cover in general the type of system to be installed, the relative economies of steam and water power and the effect of the electrification upon operating conditions.

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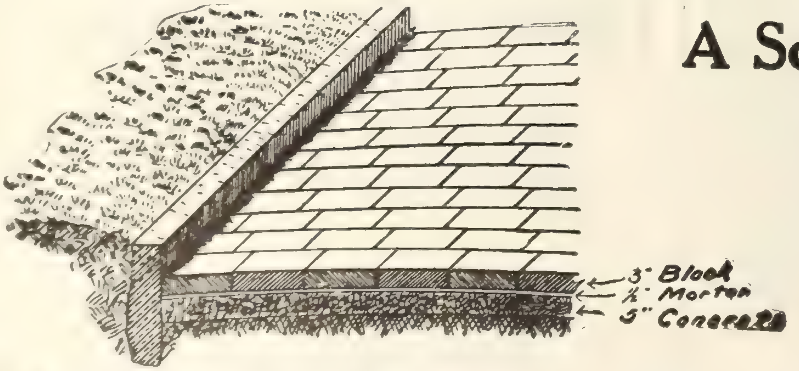

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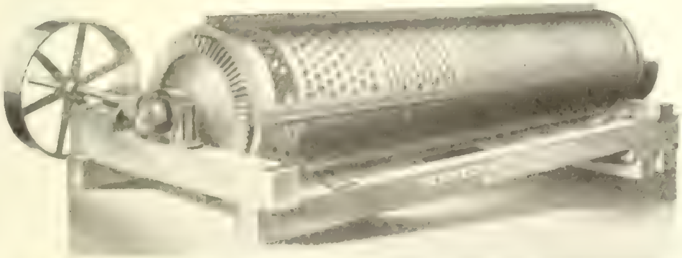

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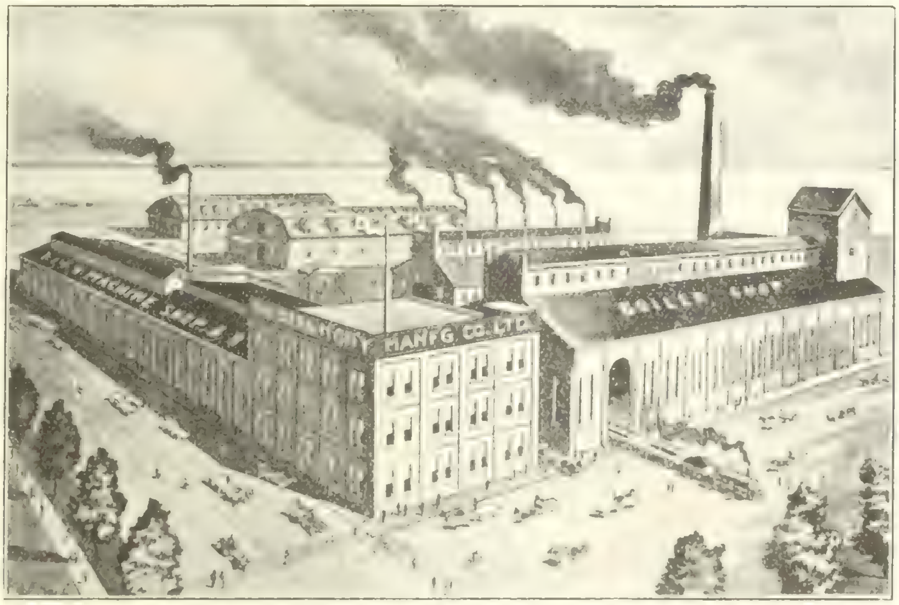

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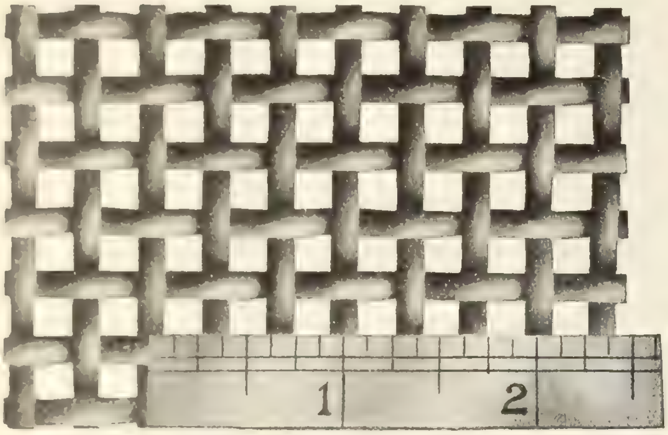

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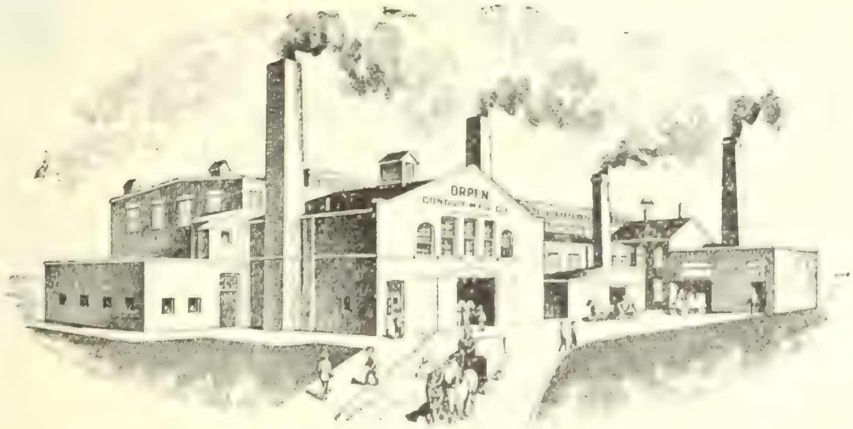

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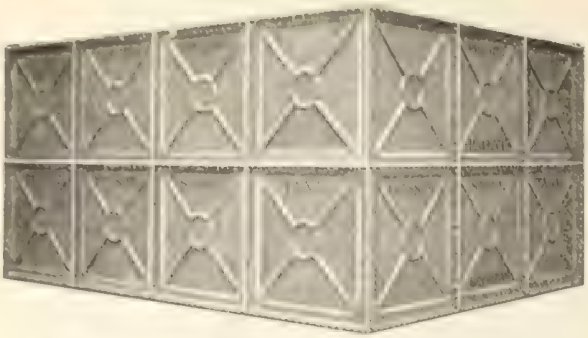

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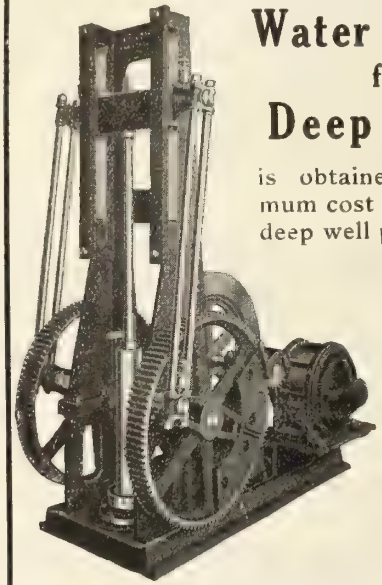

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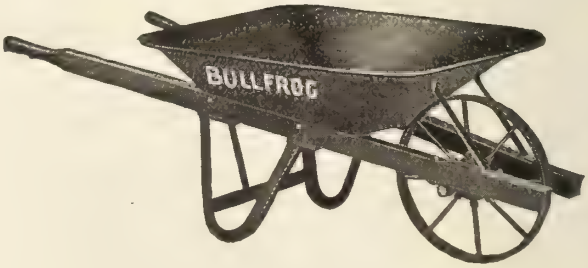

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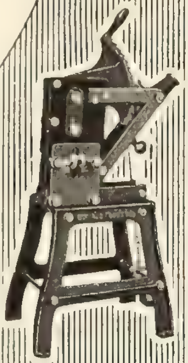

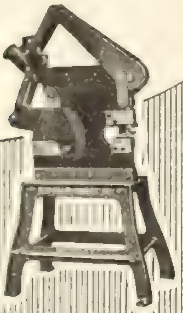

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Among our recent designs is the Bar Cutter No. 10 for cutting concrete reinforced bars twisted, round or any other shape. It cuts bars up to 1¼" thick and, due to its steel frame, its **weight is only half** that of a cast iron machine of the same capacity. Ask for catalog of Steel Punches, Shears and Drills No. 145.

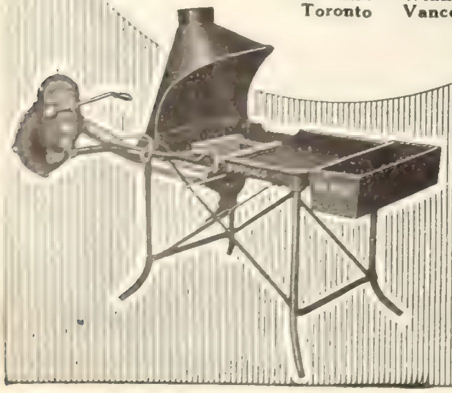
Canadian Buffalo Forge Co.
MONTREAL Limited
St. John Winnipeg
Toronto Vancouver

"Buffalo" Forges

"Built to Last"

is the slogan of our **1912 Rivet Forge.** The repair cost by this design is guaranteed to be actually **cut in two,** compared with any other forge now in the market. A bridge company using a large number of forges writes us regarding it: "The operator claims it runs easier and heats more rivets in less time than any forge he has ever used." Let us send you one on free trial. Fifty other styles, for light and heavy work.

Canadian Buffalo Forge Co.
Limited
Montreal
St. John Winnipeg
Toronto Vancouver



BOOKS
FOR
Engineers and Contractors

The following books are offered at special prices subject to previous sale:

The Concrete House and Its Construction, by Maurice M. Sloan. Published by Association of American Portland Cement Manufacturers in 1912. 224 pages; illustrated. Price $1.00.

Sewage Disposal in the United Kingdom, by Henry Lemmoin Cannon. Published in 1912 by St. Bride's Press, London, Eng. 320 pages; illustrated. Price $1.00.

Strength of Materials, by Edward H. Maurer. Published in 1908 by American School of Correspondence. 128 pages. Illustrated. Price 75c.

The Modern Asphalt Pavement, by Clifford Richardson. Published in 1910 by John Wiley & Sons, New York. 630 pages; illustrated. Price $2.00.

Text-Book on Highway Engineering, by Arthur H. Blanchard. Published in 1913 by John Wiley & Sons, Inc., New York. 762 pages. Illustrated. Price $3.00.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price $1.50.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price $1.00.

Asphalt Construction for Pavements and Highways, by Clifford Richardson. Published in 1913 by McGraw-Hill Book Company, New York. 156 pages. Illustrated. Price $1.50.

Concretes, Cements, Mortars, Plasters and Stucco, by Fred T. Hodgson. Published in 1906 by Frederick J. Drake & Co., Chicago. 520 pages. Price $1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

Specifications for Street Roadway Pavements, by S. Whinery. Published in 1913 by McGraw-Hill Book Company, New York. 116 pages. Price 75c.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Reinforced Concrete Construction, by George A. Hool. Published in 1912 by McGraw-Hill Book Company, New York. 254 pages. Illustrated. Price $2.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00.

Engineering as a Vocation, by Ernest McCullough. Published in 1911 by David Williams Company, New York. 200 pages. Price 50c.

The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons. 102 pages. Illustrated. Price 50c.

Reinforced Concrete, by Charles S. Hill. Published in 1906 by The Engineering News Publishing Company, New York. 498 pages. Illustrated. Price $2.00.

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Sackville Freestone Co., Limited, Sackville, N. B.

WRITE US FOR QUOTATIONS

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Third of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

THE McARTHUR BUILDING, WINNIPEG

This building was wired with "30% PARA" Rubber Insulated Wire.

Architect: J. H. G. Russell, Winnipeg.
Engineer: Charles L. Pillsbury, Minneapolis, Minn.
Electrical Contractors: Mitchell, Gray, Electric Co., Winnipeg.

Address our nearest office

Northern Electric Company

LIMITED

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Halifax
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Successors to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C P R Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg

Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

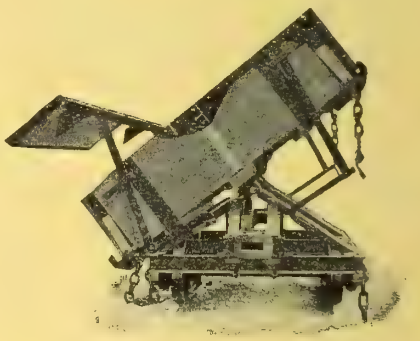
Brickyards, Quarries, Mines, Contractors, etc.

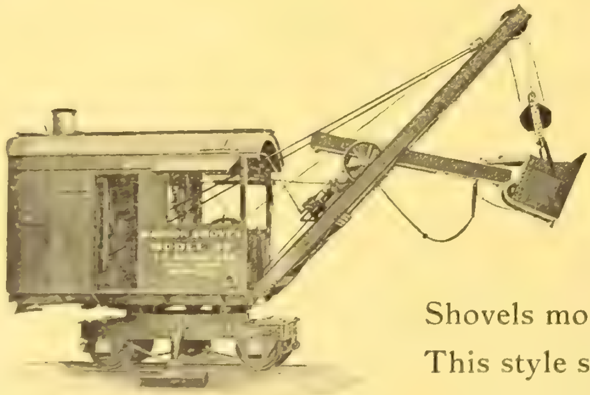
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.





"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
5/8 - 1 and 1 1/2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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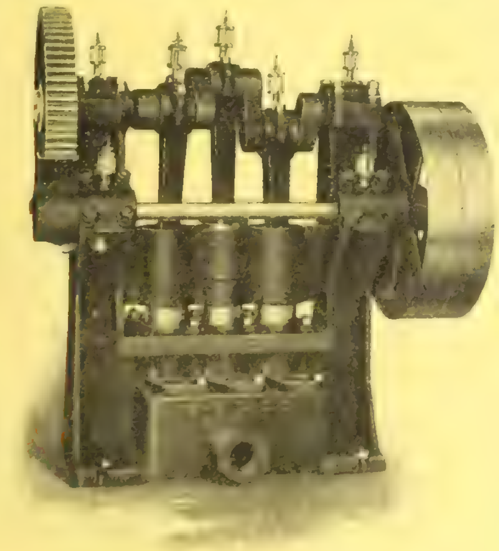
Ritchie Contracting & Supply Company, Ltd., Vancouver Agents

Vol. 28 Toronto, April 15, 1914 No. 15

Contract Record and Engineering Review

ESTABLISHED 1886

Before you buy your Pumping Machinery, write us for our catalogue, covering Steam and Power Pumps



The Smart-Turner Machine Co., Ltd., Hamilton, Canada

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited

(HILL & RUTHERFORD, Managing Directors)

Head Office and Works: 91 to 133 Don Roadway
TORONTO

Catalogue K68 Describes it.

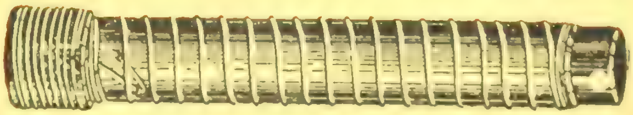
Canadian Ingersoll-Rand Co., Limited
MONTREAL, CAN.

THE "JACKHAMER"

For Shaft Sinking, Quarrying, Open Cut and Trench Work.

A "One-Man Drill"

operated by steam or air. Automatic in rotation and lubrication. All-Steel in construction.



Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge

WRITE FOR CATALOGUE

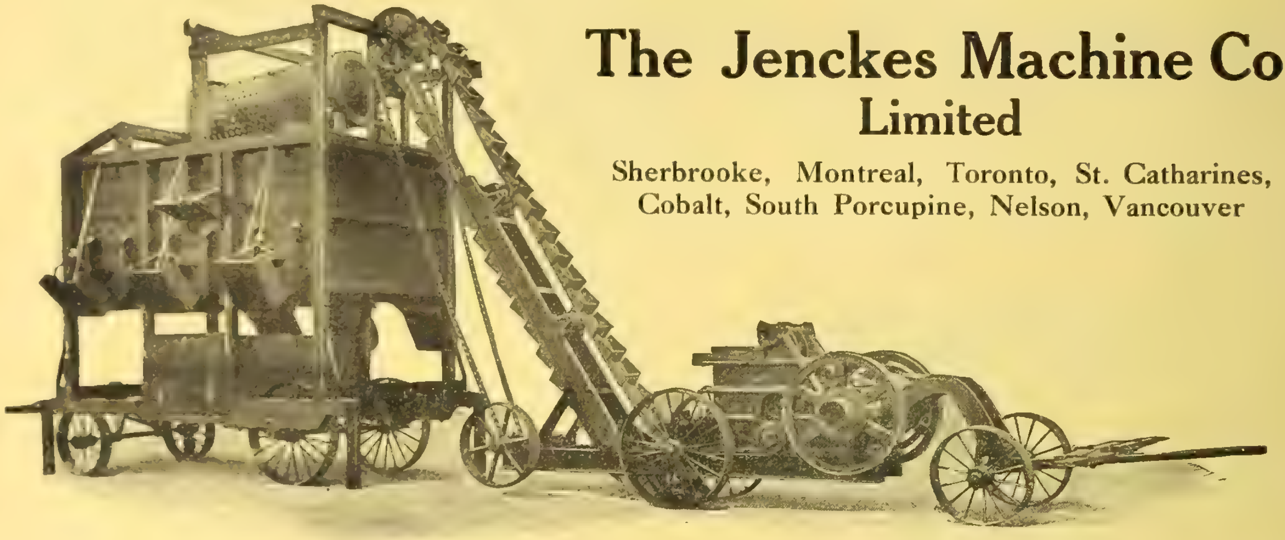
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

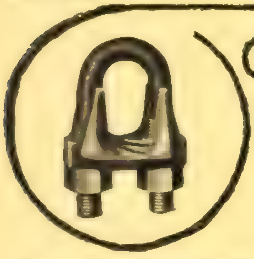
Complete and Self-Contained Rock Crushing Plants

The cut shows an outfit that can "follow the job,"—one that crushes, grades and loads. We build them in many sizes and combinations.

The Jenckes Machine Co.
Limited
Sherbrooke, Montreal, Toronto, St. Catharines,
Cobalt, South Porcupine, Nelson, Vancouver



The Genuine Crosby Clip is the Ideal Reinforcement Bar Connection



Here is a Genuine "CROSBY" CLIP

Part of the Steel work of the Duluth Reservoir

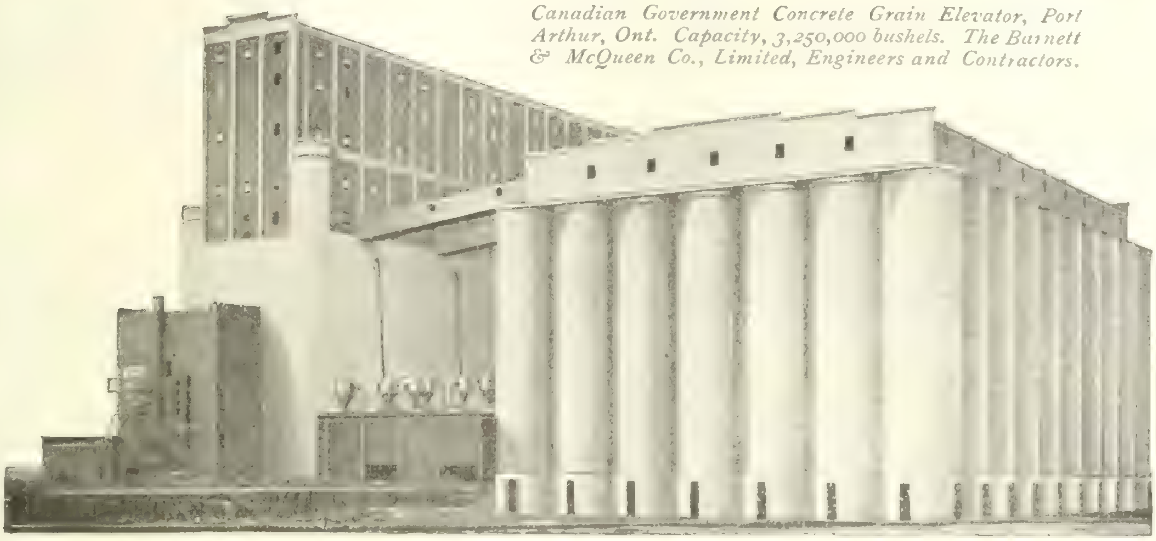
It has made possible such efficient yet economical reservoirs as those constructed by the city of Duluth, Minn., the state of Illinois at Anna, Ill., and by the Anheuser-Busch Brewing Co., at St. Louis, Mo. Full particulars on request.

The "CROSBY" Clip is drop forged from a special grade of steel—galvanized to prevent rust. It has tremendous gripping power. Once tightened, it will not pull out, break out, nor rust out.

MANUFACTURED BY
AMERICAN HOIST & DERRICK CO.
St. Paul, Minn., U. S. A.

SOLD BY: General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot, Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

Here is how the "CROSBY" Clip is used to connect reinforcement bars



Canadian Government Concrete Grain Elevator, Port Arthur, Ont. Capacity, 3,250,000 bushels. The Barnett & McQueen Co., Limited, Engineers and Contractors.

Government Adopts Concrete

The best evidence of the practicability and economy of concrete for the building of large structures is contained in this illustration of the Canadian Government Concrete Grain Elevator at Port Arthur, Ontario.

The practicability and economy of concrete lie in its adaptability to any structural design, its great strength and its durability. It is unburnable, practically indestructable, and

Minimizes Maintenance Cost

Concrete, on account of its adaptability, affords unlimited possibilities in the design of all classes of structures. The fact that the greater part of the materials and labor that go into a concrete structure, may be obtained locally, makes its use economical and convenient from the viewpoints of both engineer and contractor.

Complete information about concrete structures will be sent to anyone interested, without charge. State nature of building on your postal card of request.

Information Department

Canada Cement Company
Limited
881 Herald Building, Montreal

Put the Hardy on your Pay Roll

THE HARDY SIMPLEX HAMMER DRILL

will prove to be the best wage earner on your job.

It will drill in any rock faster than any hand hammer drill on the market, and will be more economical.

TWO SIZES

B 6—For all ordinary rock work.

B 7—For the very hardest of rocks.

Carried in Stock.

Literature Sent on Request.

Mussens Limited

MONTREAL 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.

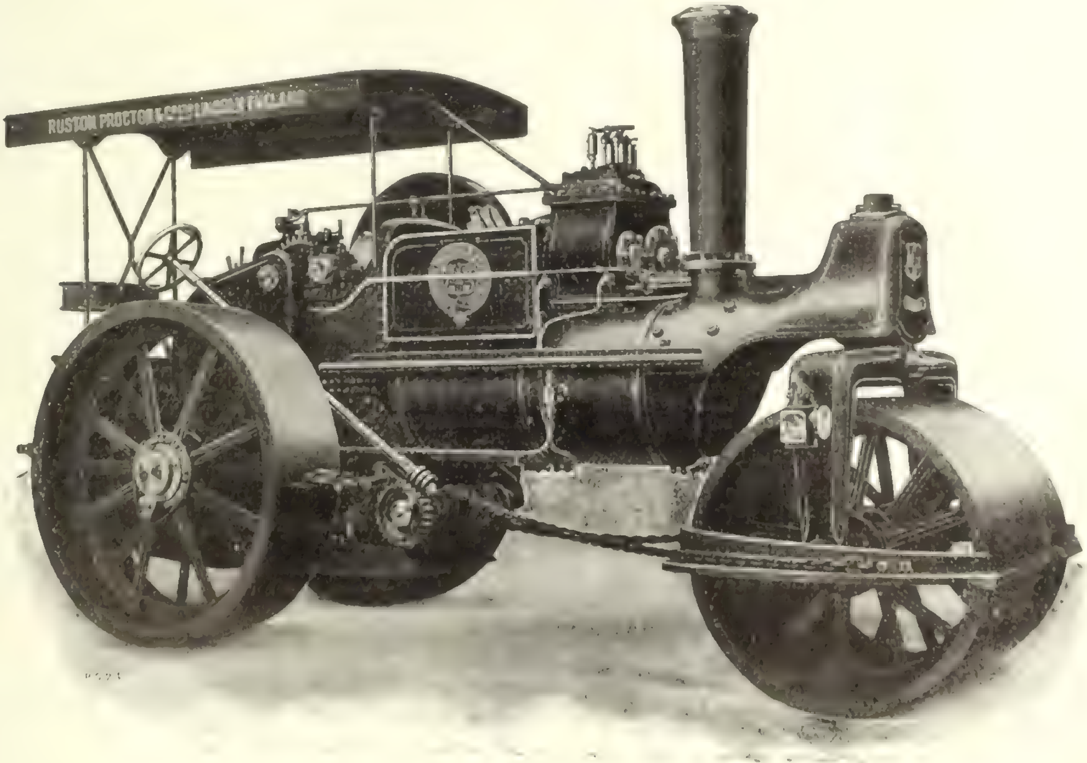
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

The First Cost vs. the Final Cost

RUSTON-PROCTOR ROAD ROLLERS

(Compound Cylinder)

Have proven themselves to be the most economical road rollers. They will cost more to buy, but the saving in repairs, combined with the saving in fuel and working costs, totals a smaller final cost than a cheaper machine.



Examine the RUSTON ROLLER which will be on exhibit, with other Road Making Machinery, at the Montreal Good Roads Congress, May 18th to 23rd.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.

QUEBEC, 31 St. Louis St.
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Hull Iron & Steel Foundries ..

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Canadian Ingersoll-Rand Co.

Drop Forgings
Canadian Billings & Spencer, Ltd.

(Continued on page 12)

Built for C.P.R. Montreal

Canadian Plant

Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service. We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

OFFICES : **Bridgeburg, Ont., 130 Janet St.**
Chicago, Ill., 1360 W. 105th St.

SHOPS : **Bridgeburg, Ont.**
Chicago, Ill.
Greenville, Pa.

LIDGERWOOD—CRAWFORD

DRAG-LINE EXCAVATORS

STEAM OR ELECTRIC MOTIVE POWER

This illustration shows a finished canal dug by four Class "B. F." "Lidgerwood - Crawford" Excavators through swamp lands in Florida.

Built with booms from 40 feet to 115 feet in length. Especially adapted for irrigation and drains, railway embankments and levees, stripping overburdens from coal, iron ore, etc.

Send for bulletin 103 for complete description.

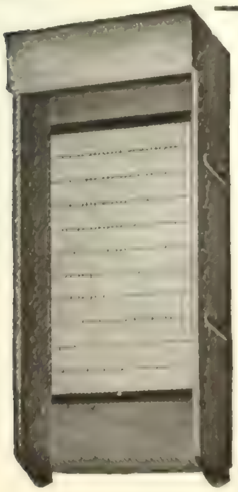
Excavator at work.

CANADIAN ALLIS-CHALMERS

LIMITED

Manufacturers of Air Compressors, Avery Scales, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Lidgerwood Engines and Cableways, Locomotives, Logging Machinery, Mining and Crushing Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Shovels, Steam Turbines, Turbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water Wheels, Water Pipe.

HEAD OFFICES: TORONTO. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver., Victoria, Prince Rupert



NOW is the time to renew your

SAND and GRAVEL SCREENS

We make SCREENS for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
Hamilton

WELLS AND GRAY, LIMITED

Engineers and Contractors

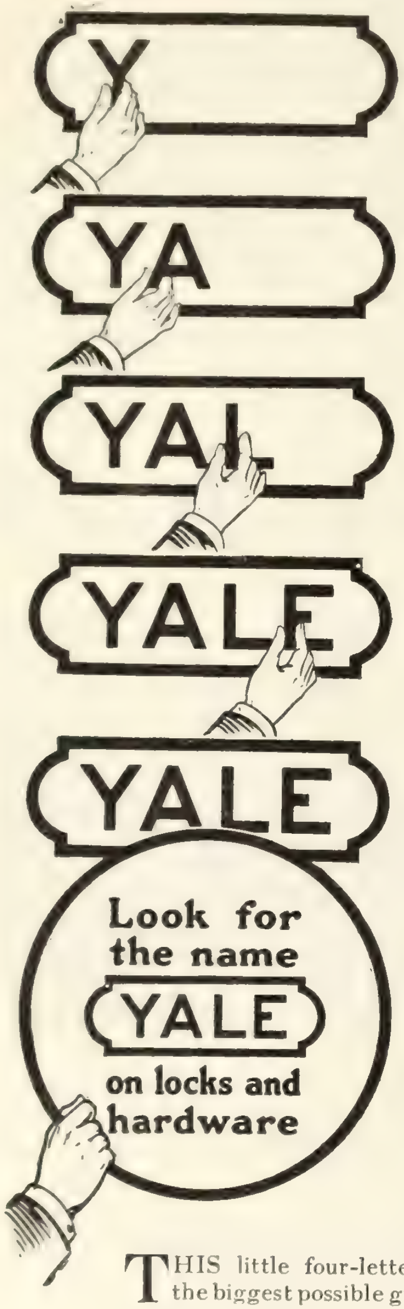
Buildings and Construction Work

OF ALL KINDS

Reinforced Concrete a Specialty

Write us for preliminary plans, estimates and photos of our work.

247 Confederation Life Building, TORONTO, ONT.



THIS little four-lettered word is the biggest possible guarantee you can have of quality, security and fitness in Locks, Padlocks, Night-latches, Door Closers, or Builders' Hardware.

Back of this guarantee stands an enviable record of successful achievement, built upon better goods, made in a better plant, and by better workmen.

Any good hardware dealer can show you Yale Products. Yale Locks and Hardware sold in Canada are now made in Canada.

Canadian Yale & Towne Limited

Makers of Yale Products

General Office and Works: St. Catharines, Ont.

Your responsibility to the architect

who gives you an important contract is greater than merely following specifications. For if there is dissatisfaction with the finished job on the part of the client, the architect—consciously or unconsciously—is going to lay a good part of the blame on you. Many a contractor has gotten in wrong with an architect through failing to catch the "spirit" behind the written specifications.

So when you find a specification calls for

Dougall Varnish

—" or just as good"—remember that the "just a good" goes in as a matter of habit. Few architects who have really tested varnishes ever make the error of thinking there is a substitute that will give the same wonderful wear and absolute satisfaction as DOUGALL VARNISHES.

When you see "Dougall Varnish" in the specification, figure on Dougall Varnish—and use it on the job. Then you can't go wrong. There is a Dougall Varnish for every purpose—a guarantee for every can.

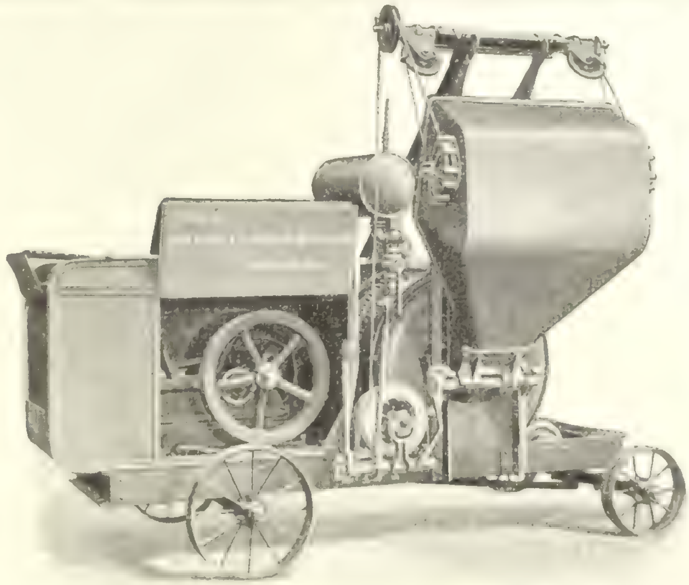
The Dougall Varnish Co., Limited

MONTREAL, QUE.

Associated with Murphy Varnish Co., U. S. A.

ANNOUNCEMENT

Most Mixing



Least Fixing

It is with much satisfaction that we announce to the contractors and builders of Canada our recent connection with the Marsh-Capron Mfg. Co., of Chicago. Knowing full well the heavy demands placed upon a concrete mixer in Canada we spared no effort to determine which, in our estimation, was the best mixer built. As a result of this investigation we are proud to offer

THE M-C RAIL TRACK MIXER

Equipped with Fairbanks-Morse Gasoline Engines

There are several hundred of these mixers in successful operation in Canada—there were five used on the big C. P. R. irrigation job at Bassano, Alberta. We carry a complete stock of all sizes and equipment at our several warehouses and are always in a position to make immediate shipments quick.

Write our nearest branch

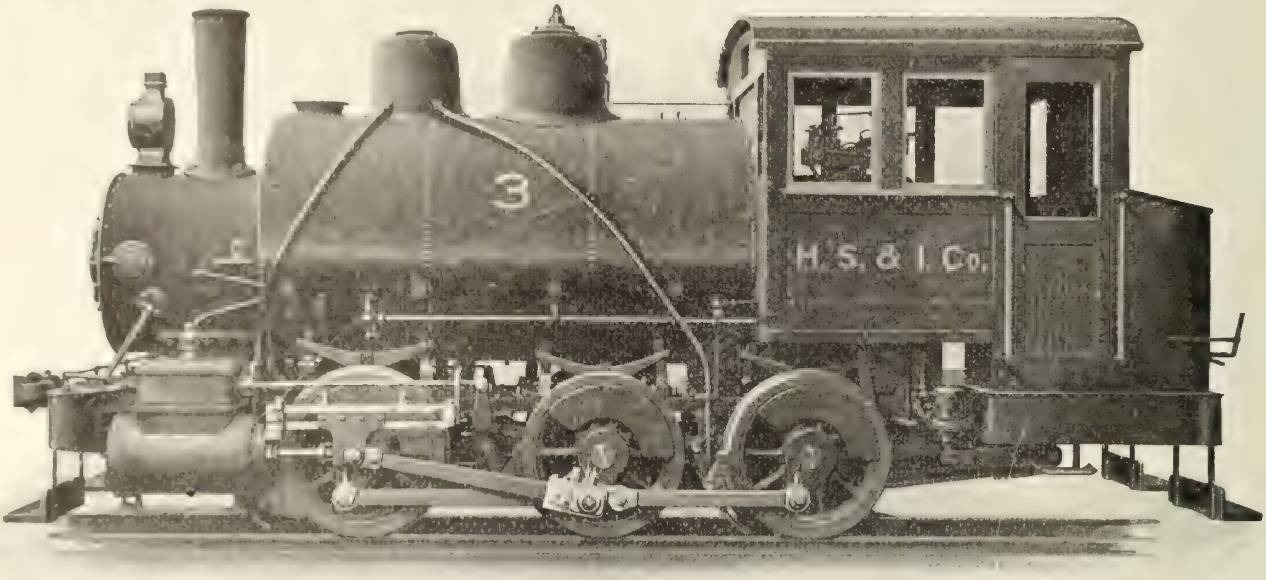
CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engines built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

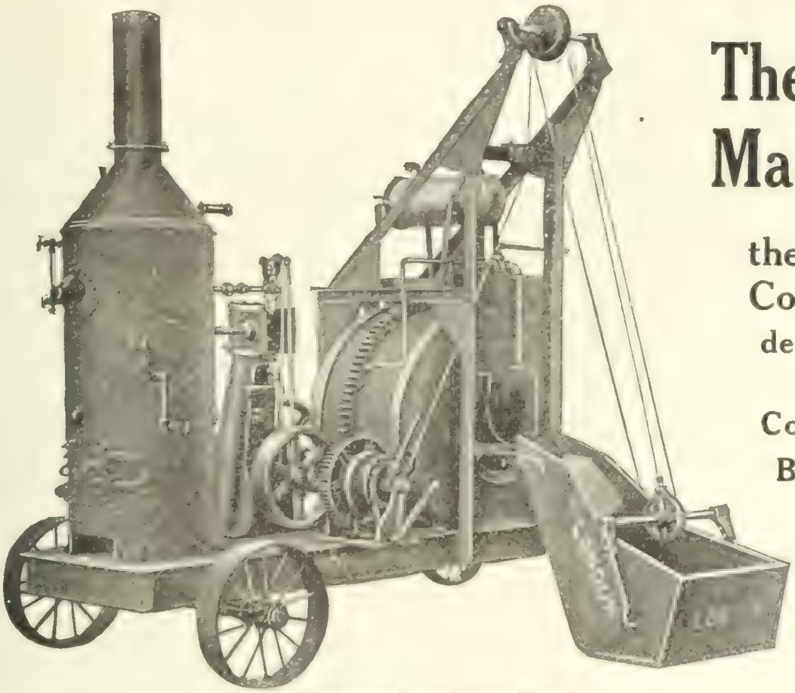
VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names in Mind when Ordering High Grade Brick.

Beaver Clay Mfg. Co.
Columbus Brick and Terra Cotta Co.
Hydraulic-Press Brick Co.
Hocking Valley Fire Clay Co.
Kushequa Brick Co.
Ohio Mining & Mfg. Co.
Pearl Clay Products Co.
Tiffany Enameled Brick Co.

BLACK BUILDING SUPPLY CO., LTD. - TORONTO



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

The London Concrete Machinery Co., Limited

the Largest Manufacturers of Concrete Machinery in Canada,
desire to quote prices to intending purchasers of
Concrete Mixers, Hoisting Engines, Block Machines, Brick Machines, Tile Moulds, Derricks, Cars, Pumping Outfits and Scrapers.

Head Office and Factory
London - Ont.

BRANCHES:
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TORONTO (112 York St.) F. D. Emsley, Mgr.
CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr
HALIFAX (68 Upper Water Street) R. R. Power, Manager

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VANCOUVER, B. C. Equipment Co.
FORT WILLIAM, Northern Eng. & Supply Co.
MONTREAL, Foss & Hill Mach. Co
QUEBEC, A. D. Masson

Sherardized Herringbone Lath

Is the *Acme* of *Perfection*

Five exposure tests on galvanized conduit pipe have just been completed at the Northern Chemical Engineering Laboratory, Madison, Wisconsin. In these tests Sherardized pipe proved best in four cases, hot galvanized best in one, and electro-galvanized uniformly "also ran."

The case in which hot galvanized proved best was exposure in an underground tunnel carrying steam pipes. The frame when recovered was fallen down and partly covered with dirt and the test was regarded as inconclusive.

Why don't you test Sherardized Lath?

Clarence W. Noble, ***General Sales Agent***
Winnipeg 117 Home Life Building, TORONTO Montreal
The Metal Shingle & Siding Company, Manufacturers

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Dump, Cars, Wheels, etc.
  [illegible] Limited
  Manitoba Bridge & Iron Works
  [illegible] Foundry & Machine Co
  Western Wheeled Scraper Co
  Weller Mfg. Co.
  [illegible] Limited

Dump Carts and Wagons
  Deere Plow Co., John.
  [illegible] Wagon Works

Drying Apparatus
  Sturtevant Co. of Can. Ltd. B. F.

Electric Fans
  Sturtevant Co. of Can. Ltd. B. F.

Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electric Steel Castings
  Electric Steel & Metals Co.

Elevators
  Roelofson Elevator Works.

Enamelled Brick
  American Enamelled Brick & Tile Company

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  Boving Company of Canada
  Canadian Buffalo Forge Co.
  Canadian Sirocco Co.
  Inglis Co., John
  Jenckes Machine Co.
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks.
  Mussens Limited
  Waterous Engine Works Co.
  Wettlaufer Bros.

Engineers (Civil and Mechanical)
  Bowman & Connor
  Campbell, R.
  Chipman & Power
  Dominion Engineering & Inspection Company.
  Farmer, John T.
  Galt Engineering Co., John
  Lea & Ferguson
  Mitchell, C. H.
  Thorold Co., F. W.
  Tyrrell, H. G.

Excavators
  Austin Drainage Excavator Company, F. C.
  Brown Hoisting Machinery Co.
  Municipal Engineering & Contracting Company.
  Parsons Company, G. W.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Expansion Bolts
  Star Expansion Bolt Co.

Expanded Metal
  Mannesmann Tube Co.
  Pedlar People Limited.

Fans
  Canadian Sirocco Co.
  Sheldons Limited.
  Sturtevant Co. of Can. Ltd. B. F.

Fuel Economizers
  Sturtevant Co. of Can. Ltd. B. F.

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  Ferranti Electrical Co.
  Sturtevant Co. of Can. Ltd. B. F.

Field Instruments
  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Fire Brick
  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works.
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry.
  Mussens Limited
  Pedlar People Limited.
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Fixtures (Gas)
  Consumers Gas Co.

Folding Doors
  Springer, O. T.

Forges
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

Gas Engines
  Armstrong Mfg. Co.
  British Mfrs. Assn. of Canada.

Gasoline Engines
  Armstrong Mfg. Co.
  Original Gas Engine Co.
  Wettlaufer Bros.

Glass
  Consolidated Glass Co.
  Excelsior Plate Glass Co.
  Hobbs Mfg. Co.
  Luxfer Prism Co.
  Toronto Plate Glass Imp't'g Co.

Gravel Washing Plants
  Dull Co., Raymond W.

Hammer Drills
  Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Escher Wyss & Co.
  Mannesmann Tube Company.
  Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Fairbanks-Morse Co.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
  Marsh & Henthorn
  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Royce Limited
  Sturtevant Co. of Can. Ltd., B. F.

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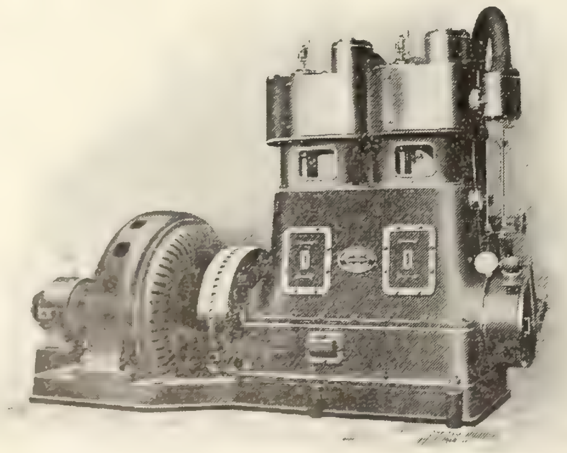
BRUCE PEEBLES



Peebles-Browett Alternator Set

Alternators and Generators

are built suitable for belt-drive or for direct coupling to any form of prime mover.

Send Us Your Enquiries

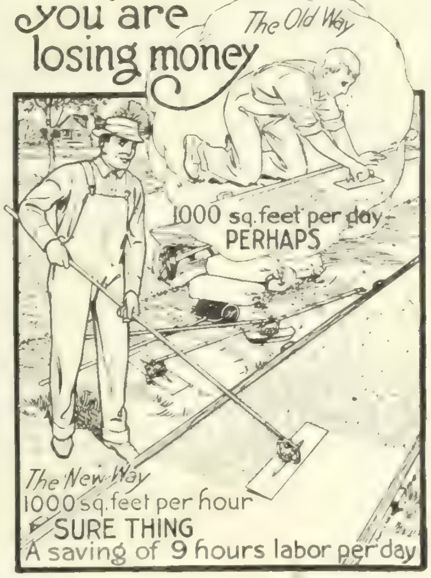
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO
Farmers' Advocate Building, Cor. Notre Dame & Langside, WINNIPEG

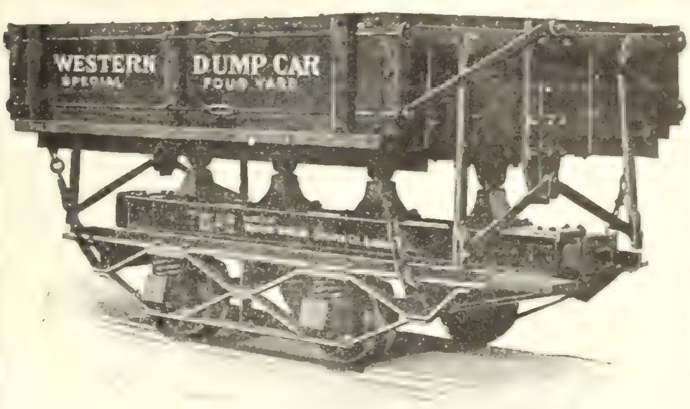
If you are not using

"ABRAM" TOOLS

It is plain to be seen you are losing money


The Old Way
1000 sq. feet per day PERHAPS
The New Way
1000 sq. feet per hour
SURE THING
A saving of 9 hours labor per day

Abram Cement Tool Co.,
Windsor, Ontario



It is a well known adage that necessity is the mother of invention. The immense earth moving enterprises undertaken and accomplished in the past few years have necessitated the perfection of a dump car for handling material quickly and economically. The satisfactory dump car which meets every requirement—the dump car of the

Past, Present and Future

is the

WESTERN DUMP CAR

Write for Catalogue.

WESTERN WHEELED SCRAPER CO.
AURORA, ILLINOIS

Earth and Stone Handling Machine

Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta.
Can. Equipment Co., Montreal—Agents for Eastern Canada.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Heating Apparatus
  Canadian Buffalo Forge Co.
  Canadian Sirocco Co.
  Sheldons Limited

Hoists
  Roelofson Elevator Works
  Northern Crane Works.

Hoisting Engines
  Canadian Allis-Chalmers, Ltd.
  Canadian Fairbanks-Morse Co.
  Wettlaufer Bros.

Hydrants
  Canada Iron Corporation
  Gartshore-Thomson Pipe Co.
  Kerr Engine Company

Ice-making Machinery
  Linde British Refrigeration Co.

Insulating Compounds
  Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
  Batts Limited
  Canada Office & School Fur. Co.
  Rhodes Curry & Co.

Jib Cranes (all kinds)
  Brown Hoisting Machinery Co.
  Morris Crane & Hoist Co., Herbert.

Kilns
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Sturtevant Co. of Can. Ltd., B. F.
  Canadian Sirocco Co.
  Berg Machinery Mfg. Co.

Lime
  Dominion Lime Company.
  Jamieson Lime Co.
  Ontario Lime Co., Ltd.
  Standard White Lime Co.

Lighting and Pumping Installations
  Lister & Co., Ltd., R. A.

Locks
  Can. Yale & Towne Ltd.

Locomotives
  Boving Company of Canada
  Canadian Allis-Chalmers, Ltd.
  Canadian Locomotive Company
  Montreal Locomotive Works
  F. H. Hopkins Co.
  Mussens Limited

Metal (Anti-Corrosive)
  Stark Rolling Mill Co.

Metal Lath
  Greening Wire Co., B.
  Metallic Roofing Co.
  Noble, C. W.
  Pedlar People Limited.
  Steel & Radiation Ltd

Meters, Electrical
  Ferranti Electrical Mfg. Co.
  Canadian Allis-Chalmers, Ltd.

Mechanical Draft Apparatus
  Sturtevant Co. of Can. Ltd. B. F.

Meters, Water
  Hopkins & Co., F. H.
  McDougall Caledonian Iron Wks
  Neptune Meter Co.

Overhead Runways
  Brown Hoisting Machinery Co.
  Morris Crane & Hoist Co., Herbert.

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  Dominion Paint Works
  Hopkins & Co., F. H.

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  Asphalt & Supply Co.
  Aztec Oil Asphalt Co
  Baker Co., R. D.
  Barber Asphalt Paving Co.
  Dominion Creosoting Company
  Ontario Asphalt Block Co.
  Paterson Mfg. Co., B.

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  American Spiral Pipe Works
  Canadian Allis-Chalmers, Ltd.
  Canadian Pipe Co.
  Dominion Concrete Co.
  Gartshore-Thomson Pipe Co.
  Mannesmann Tube Company.
  National Concrete Mfg. Co.
  National Iron Works
  National Pipe & Foundry Co.
  Pacific Coast Pipe Co.
  Piggott & Co., Thos.
  United States Cast Iron Pipe Co
  Vancouver Wood Pipe & Tank Company.
  Walsh Plate & Structural Works.

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  Dominion Paint Works

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  Greening Wire Co., B.

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  Sutcliffe, Speakman & Co.

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  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Ingersoll-Rand Co.
  Lecky & Collis

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  Mueller Mfg. Co., H.

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  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Plaster
  Alabastine Hardmortar Co.
  Albert Mfg. Company
  Britnell & Company
  Ontario Lime Co., Ltd.

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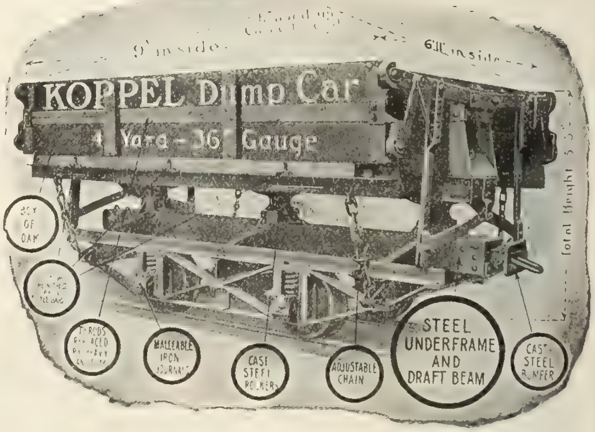
What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein - Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

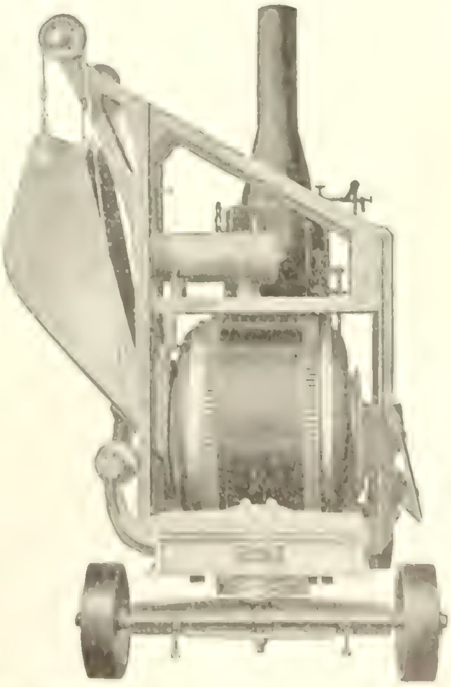
Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.



KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW

KOEHRING MACHINE CO.

Milwaukee, Wisconsin

Canada Sales Agent CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

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Dietrich Limited

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Canadian Ingersoll Rand Co

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British Mfrs. Assn. of Canada.
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Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
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Hamilton Mfg. Co., Wm.
Honig & Mock.
Inglis & Company, John
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Morris Machine Works.
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Wettlaufer Bros.

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Jenckes Machine Company
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Waterous Engine Works

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Lecky & Collis
Mussens Limited

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Brown Hoisting Machinery Co
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Dominion Iron & Steel Co.
Greening Wire Co., B.
Pedlar People Limited.
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
Turner, C. A. P.

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Linde British Refrigeration Co.

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Barber Asphalt Paving Co.

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Mussens Limited
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Western Wheeled Scraper Co.

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Hope & Sons, Henry.

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Sand and Supplies Limited
York Sand and Gravel Co.

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Goodwin, Barsby & Company.
Greening Wire Mfg. Co., B.
Weller Mfg. Co.

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Britnell & Company
Canada Iron Corporation
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sewer Trenching
Lecky & Collis

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Mussens Limited
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Thew Automatic Shovel Co.

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DesMoines Bridge & Iron Co.
Hamilton Mfg. Co., Wm.
Manitoba Bridge & Iron Works.
Pittsburgh-DesMoines Steel Co.
Walsh Plate & Structural Works

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Pittsburgh Valve, Foundry and Construction Company
Sheldons Limited

Steel Doors
Gray Mfg. & Machine Co.

Steel Trucks
Gray Mfg. & Machine Co.

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Steam Turbines
British Mfrs. Assn. of Canada.
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McDougall Caledonian Iron Wks.
Sturtevant Co. of Can. Ltd. B. F.

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Dominion Iron & Steel Co.
Steel & Radiation, Ltd.

Steel
Burlington Steel Company
Can. Billings & Spencer
Lecky & Collis

Steel Pipe
Gerald Lomer, Limited
Mannesmann Tube Company.
Steffens & Noble

Steel Tubes
Mannesmann Tube Co.

Sound Deadening
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McGregor & McIntyre

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Steel Sash
Hope & Sons, Henry.

Steel Sheet Piling
Drury Company, H. A.

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Britnell & Company
Brodie, James
Consolidated Stone Company
Contractors' Supply Company
Crushed Stone, Limited
Hagersville Contracting Co.
Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Parsons Company, G. W.
Queenstown Quarry Co.
Rogers Supply Company
Sackville Freestone Company
Sand & Supplies
Smyth & Ryan

Stone Saws
Anderson, Geo.

Store Fronts
Zouri Drawn Metals Co.

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Burlington Steel Company
Canadian Allis-Chalmers, Ltd.
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Dominion Bridge Company
Drury Company, H. A.
Mackinnon Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
McGregor & McIntyre
Pittsburgh-DesMoines Steel Co.
Reid & Brown
Sarnia Bridge Company
Structural Steel Company
Standard Steel Construction Co.
Toronto Structural Steel Co.
Walsh Plate & Structural Works

Submarine Drills
Lecky & Collis

Swinging Gears
Dake Engine Company

Tanks and Stand Pipes
Chicago Bridge & Iron Works
Hamilton Mfg. Co., Wm.
Inglis, John
Jenckes Machine Co.
Manitoba Bridge & Iron Works.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
Ontario Wind Eng. & Pump Co.
Piggott & Co., Thos.
Pittsburgh-DesMoines Steel Co.
Vancouver Wood Pipe & Tank Company.
Walsh Plate and Structural Wks.
Waterous Engine Works Co.

Terra Cotta
Northwestern Terra Cotta Co.

Testing and Inspecting Bureau
Hunt & Co., Robt. W.

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Sutcliffe, Speakman & Co.

Track Systems (Hand, Power and Electric)
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

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Mannesmann Tube. Co.

Turnbuckles
Canadian Billings & Spencer, Ltd.

Underground Conduit
Dietrich Limited

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Canadian Allis-Chalmers, Ltd.
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Golden Anderson Valve Co.
Kerr Engine Company
Pittsburgh Valve, Foundry & Construction Company

Ventilating & Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Company
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.
Wilson, Limited, John T.

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Tuec Company

Varnish
Dougall Varnish Co.

Varnishes—Insulating
Standard Underground Cable Co. of Canada, Ltd.

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Taylor Forbes Company

Wall Board
Bird & Son

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Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Ceresit Waterproofing Co.
Wadsworth Howland & Co., Inc.

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American Water Softener Co.
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Manitoba Bridge & Iron Works.

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Boving Company of Canada
Escher Wyss & Co.
Hamilton Mfg. Co., Wm.
McDougall Caledonian Iron Wks.

Well Drilling Machinery
Armstrong Manufacturing Co.

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Northern Electric Co.
Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
Canada Wire & Iron Goods Co.
Greening Wire Co., B.

Wire Rope
Canada Wire & Cable Co.
Greening Wire Co., B.

Wrenches
Canadian Billings & Spencer, Ltd.

Wrenches
Can. Billings & Spencer, Ltd.

Tarvia

Preserves Roads
Prevents Dust~

Beaurepaire Road, Beaconsfield, Quebec. New macadam road treated with two coats of "Tarvia B"

Dust is Expensive

When an automobile speeds down an ordinary macadam road it leaves in its wake a cloud of dust which is carried by the winds over the neighboring fields, houses and lawns.

This is just as surely a waste of good material as if the automobilist dug it out of the highway and carted it away. Dust represents waste—costly waste—and the taxpayers feel the result. A road that is properly built for modern traffic will not be dusty.

Plain macadam gives way under the wear and tear of heavy rubber-tired automobile wheels and the surface binder of the road is torn away in the form of dust, until in time the coarse stone itself is exposed and a costly renewal of the road is necessary.

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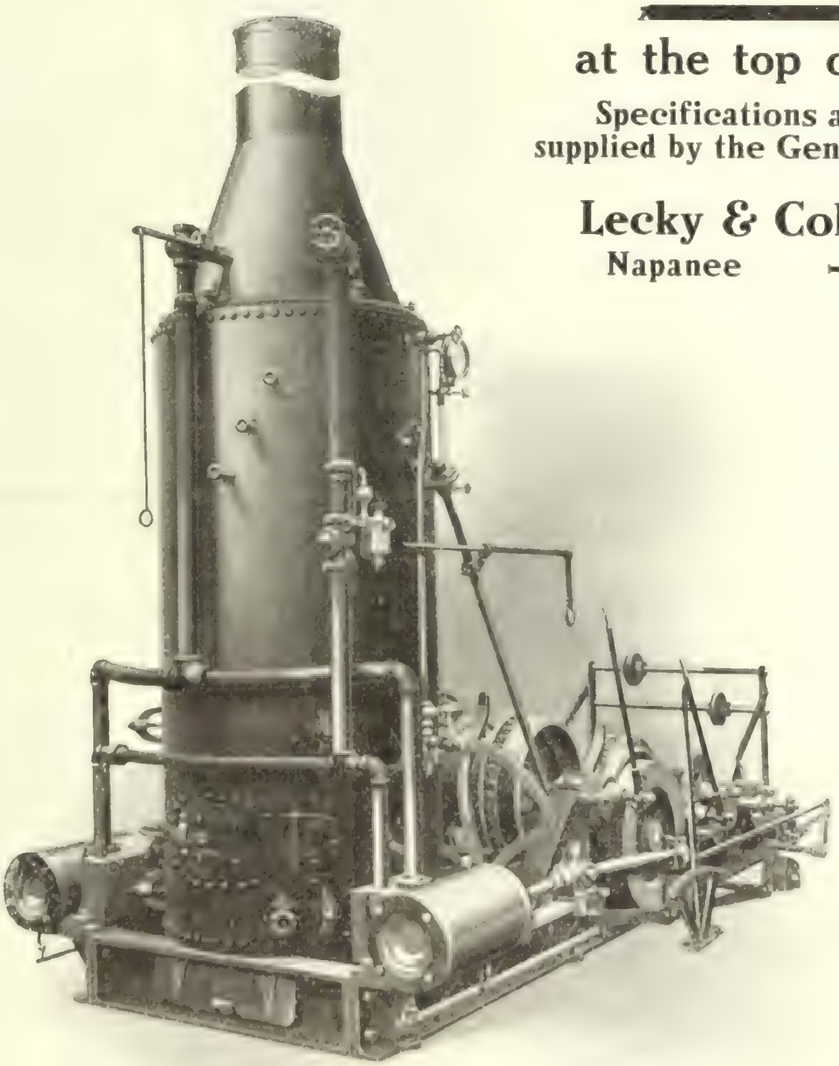

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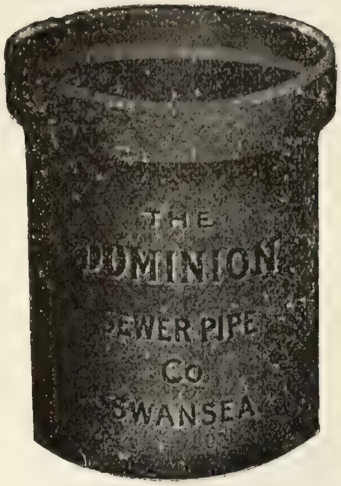

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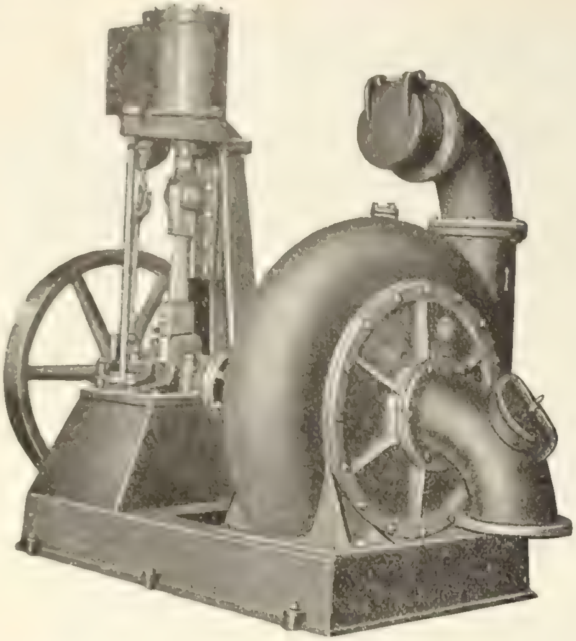

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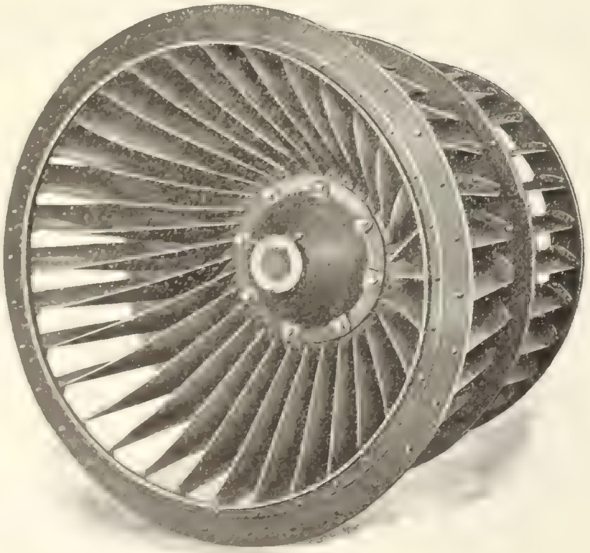

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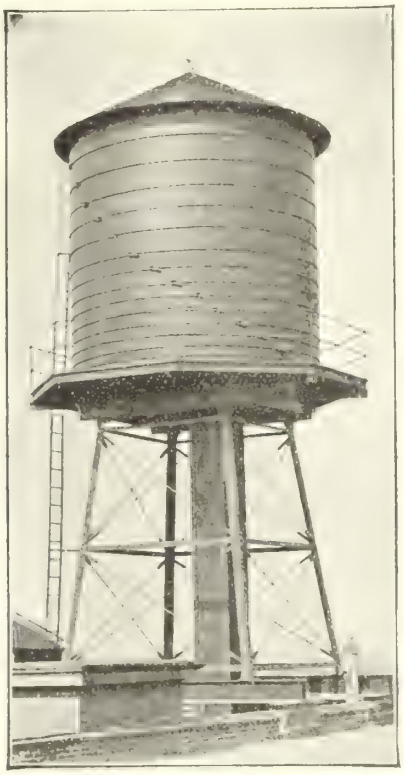

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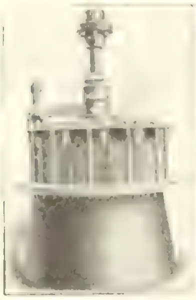

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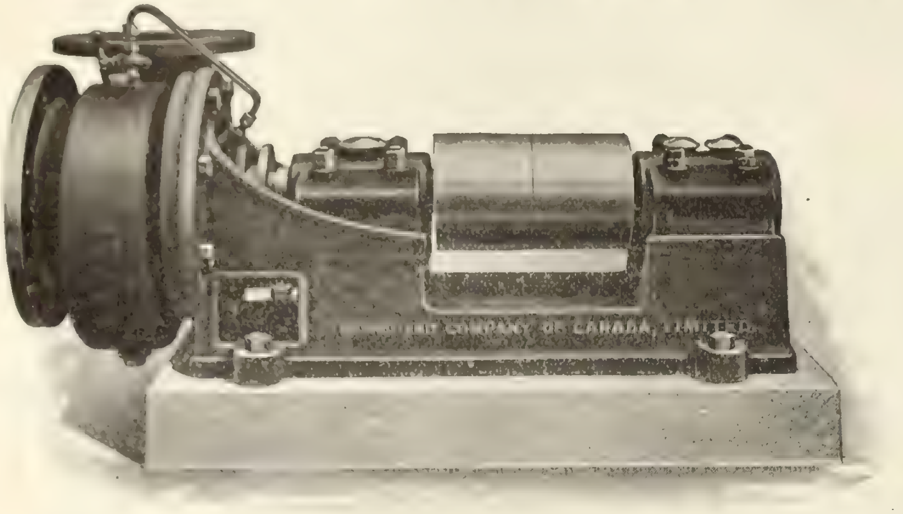

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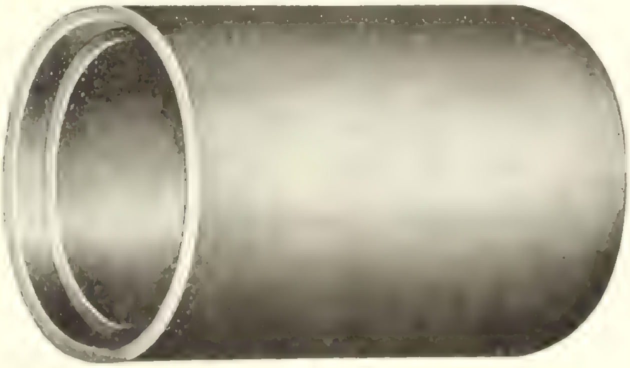

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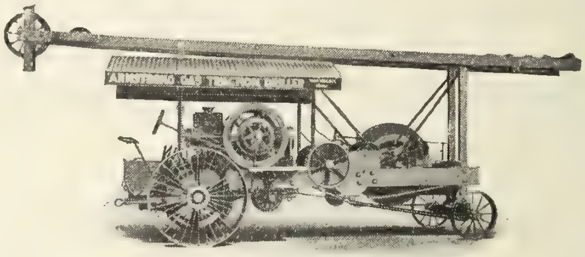

LISTEN! to reasons:—We illustrate our Water Well and Blast Hole Drills so **you** can see the difference—so that **you** will know that the drill we call our Special Blast Hole Drill is not a Water Well Drill, and so that you may "ask to be shown" by any manufacturer of cable drills the difference in the design of their blast hole and water well drilling equipment.

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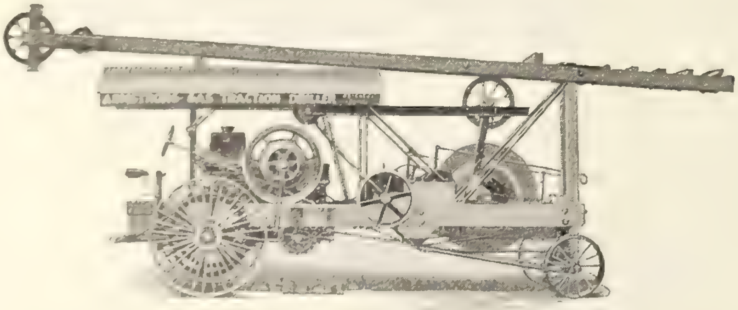

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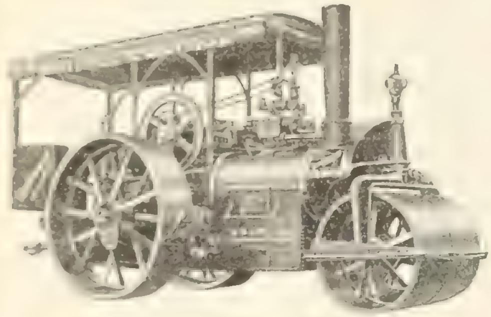

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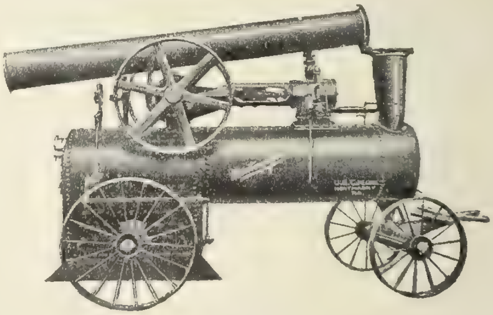

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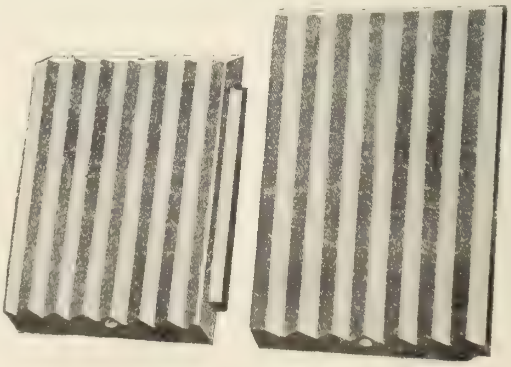

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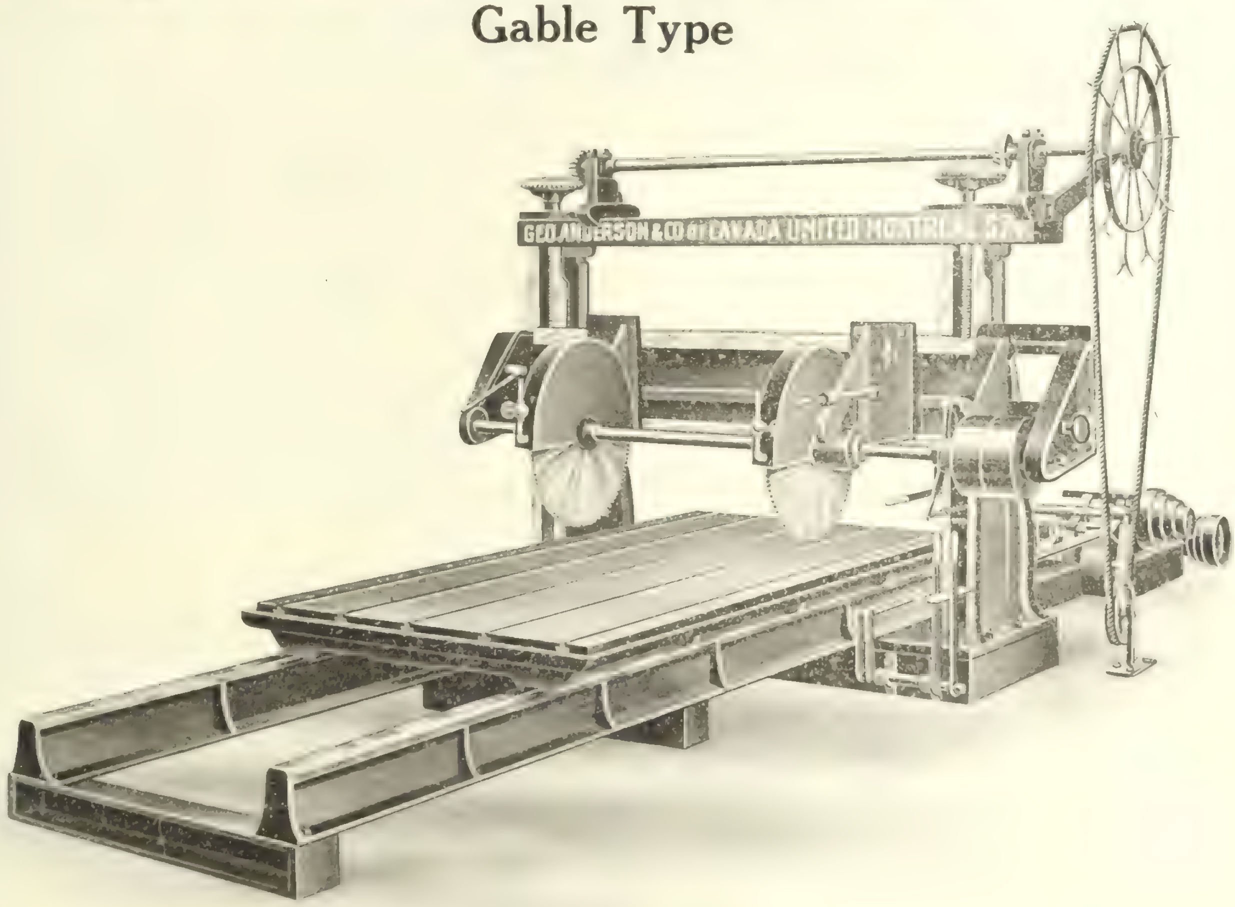
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The cutting capacity of this machine, fully loaded, with fast feed speed is 160 superficial feet per hour.

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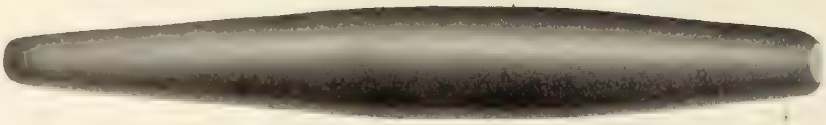

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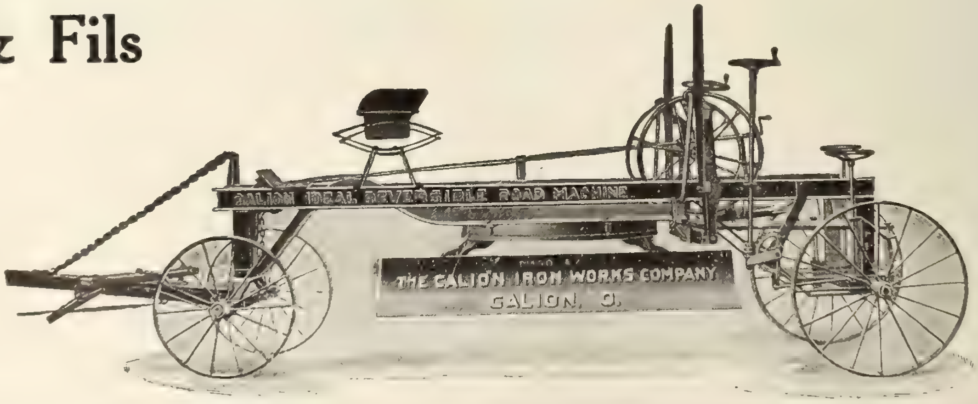
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THE GALION IRON WORKS COMPANY
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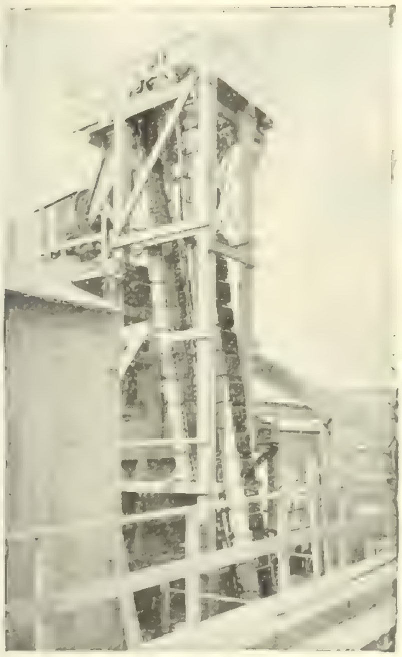

Continuous Bucket Stone Elevator

handling 300 tons per hour. Note the absence of tracks. The chains are guided by large flanged rollers. This is a heavy slow speed elevator, designed for long life.

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For Sand, Stone, Gravel, Etc.

For the contractor who is handling large quantities of sand, stone, gravel, and other rough material, a Waterous Steel Bucket Elevator will effect economies in time and labor that are worth consideration.

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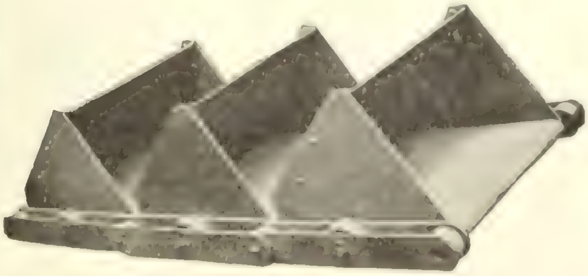

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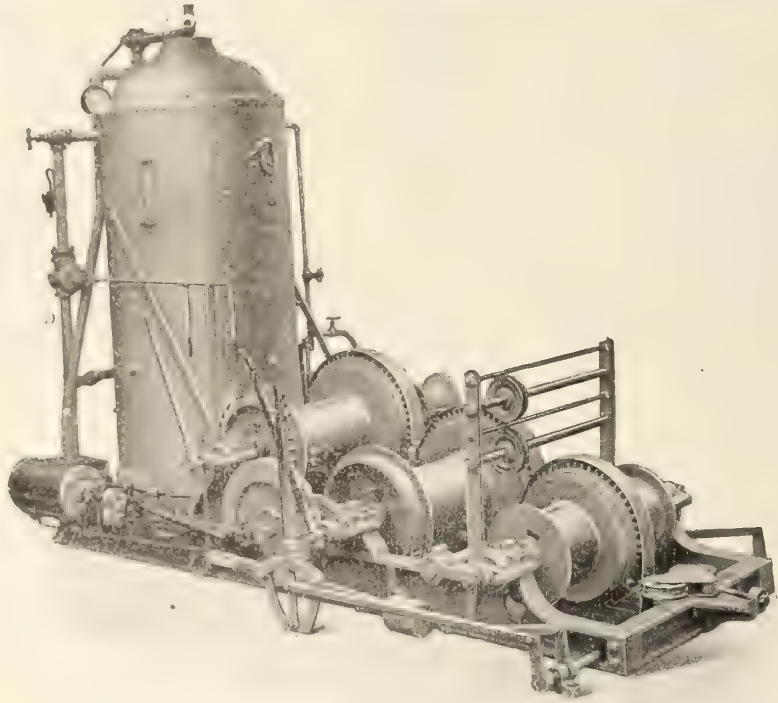

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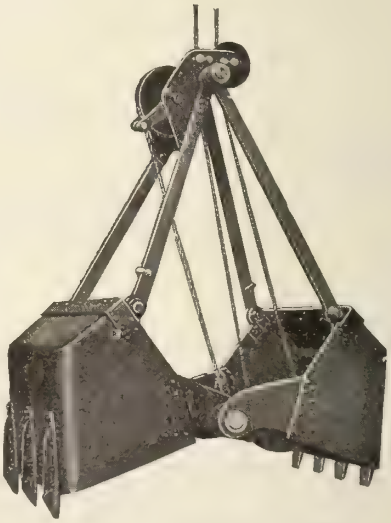

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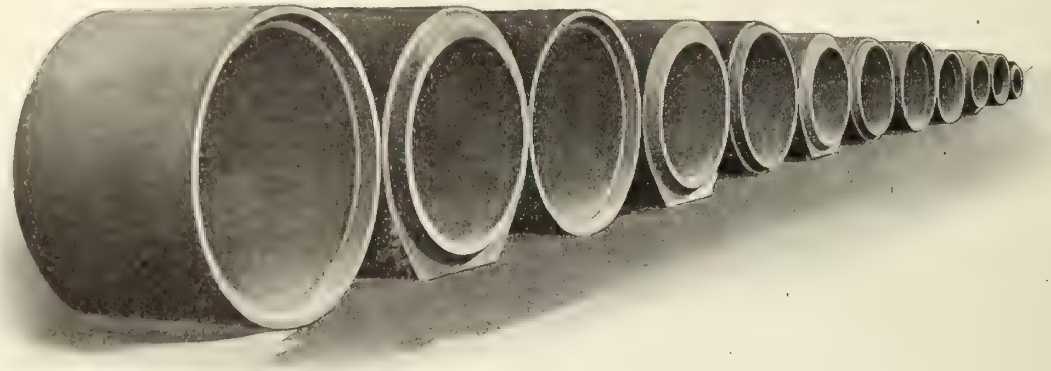

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Contract Record
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Toronto Ontario

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are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.

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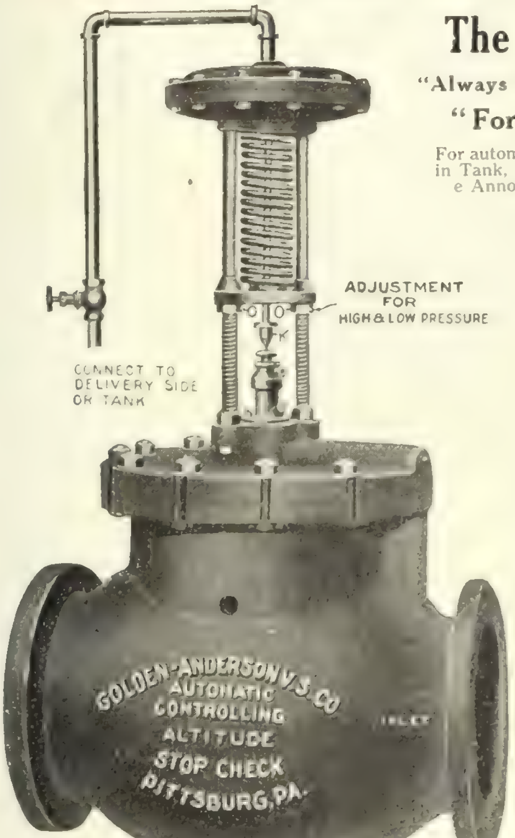
For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with e Annoyance of Float Fixtures.



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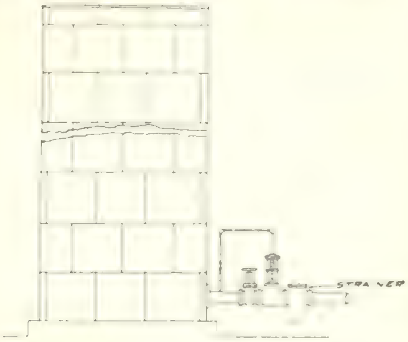
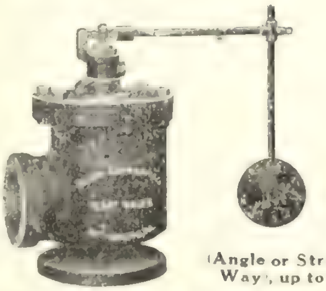
Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Golden-Anderson Float Valves



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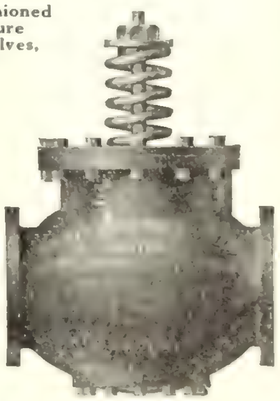
Automatic Cushioned Water Pressure Regulating Valves, up to 24



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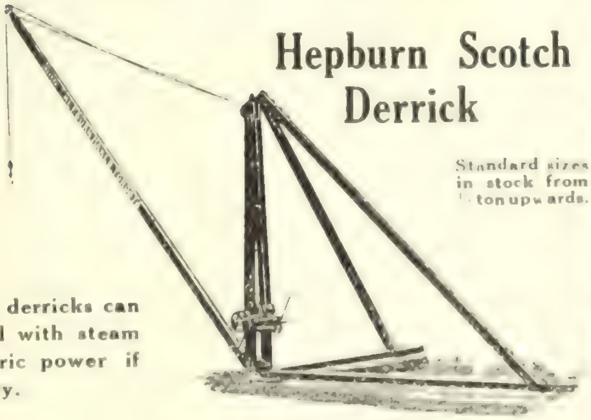
THE FAMOUS
Hepburn Scotch Derrick

IS USED ALL OVER THE DOMINION OF CANADA



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Standard sizes in stock from [illegible] ton upwards.

These derricks can be fitted with steam or electric power if necessary.

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Some of Canada's finest buildings contain Enamel Concrete Brick.
You should know about it—write us.

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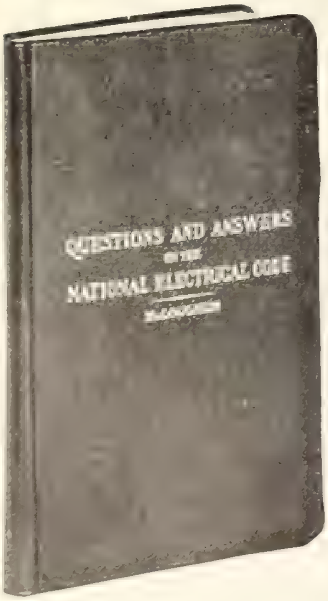

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Montreal and Toronto

"No more repair bills for that Roof"

Think of the money that can be saved by putting a roofing on buildings that has never got to be painted, graveled or repaired. Not a cent for repairs will ever have to be spent when buildings are covered with

J-M ASBESTOS ROOFING

It is the cheapest-per-year roofing on the market.

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Anyone can apply it. Don't take a substitute. J-M Roofing Cleats, packed in each roll, make absolutely watertight laps and give the entire roof a handsome white appearance. Our nearest Branch will ship direct if your dealer can't supply you.

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Manufacturers of Asbestos Roofings; Stucco; Pipe Coverings; Cold Storage Insulation; Waterproofing; Sanitary Specialties; Acoustical Correction; Cork Tiling; Fireproof Doors, Etc.

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BRICK PLANTS

Lime-Sand

Clay, Slag,

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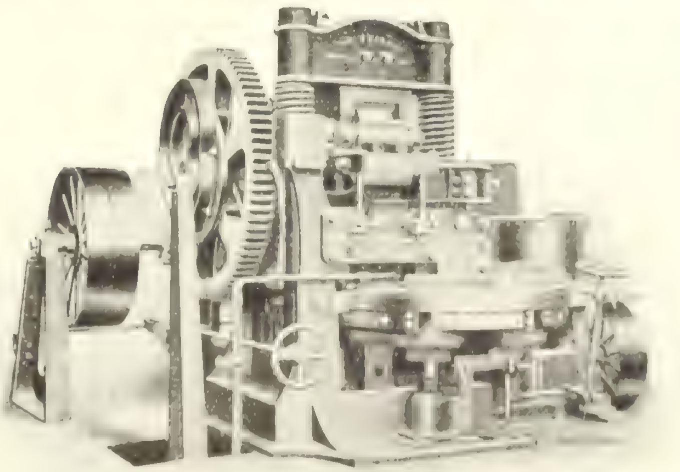
&c., &c.



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World Wide Experience.

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One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving **would have enriched your treasury approximately a** quarter of a million."

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When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record
and Engineering Review

220 King Street West, Toronto

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NATURAL
COKE OVEN and
BLAST FURNACE
GASES

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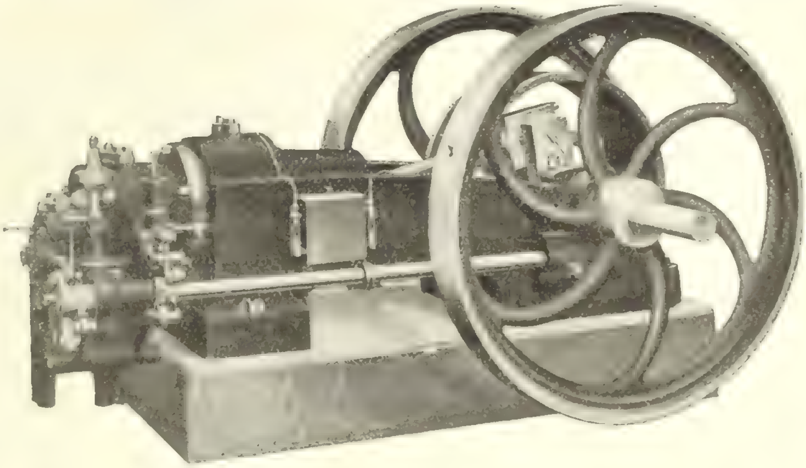

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Manitoba Bridge & Iron Works

Limited

—MANUFACTURERS—

Roofs, Steel Buildings and Structural Iron Work
of all descriptions

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Railway and Highway Bridges

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Works: Don Valley **Head Office: Traders Bank Bldg.**

ESTABLISHED 1886

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Publications Received ... [illegible]

Thirty Million Dollars for Ontario Good Roads

In connection with constructional development it may be affirmed truly that road building plays a most important part in the larger aspect of the country's growth. This is a trite observation but a none the less significant one on that account. In all ages, in every historical period, great nation-builders have been great road-builders. The roads constructed by the men who built up the great Roman empire survive today. Transportation facilities in the shape of good highways are the alpha and the omega in the attainment of industrial and national supremacy. In the wake of good roads follow all other forms of constructional activity. Farmers are assisted greatly in the ready marketing of their products and this induces a more rapid circulation of money, which in turn enables those identified with manufacturing to carry out their programmes of extension or to supply funds for the exploitation of the new territories opened up by the highways. Hard upon good roads follow settlements, villages, towns and cities, with the attendant developments in the way of buildings of all kinds—sewerage, waterworks and power.

With these convictions one cannot but regard with the greatest satisfaction and optimism the scheme contemplated in the report of the Ontario Highways Commission submitted to the legislature last week. This report recommends the expenditure of no less a sum than $30,000,000 on the market and trunk roads of Ontario during the next fifteen years. The report is a comprehensive one and deals with every phase of administrative detail. Briefly it is suggested that the provinces contribute $12,000,000, the counties $12,000,000 and the cities $6,000,000, such obligation being incurred gradually during a period of fifteen years from 1915 to 1930. The Commission realize that the extension of definite plans beyond that period would be inadvisable in view of the transitional stage in which traffic conditions and highway construction are at present. It is of interest to note that it is proposed to devote a portion of the funds to townships which are saddled with heavy expenditures on bridge work.

With the road system of the province entirely reorganized and the work in charge of a Minister, with a deputy and three advisers, as suggested, it is fair to look for unprecedented activity in Ontario during the next decade. It is not so much the amount which the scheme calls for—although this in itself is a consideration which should not be overlooked by those identified with the field in any way. Apart from the direct benefit which will accrue from the work there is the indirect benefit that will come from the example of putting such a progressive policy into effect. It is still another proof that the provinces of the country have a sure confidence in their individual destinies and are willing to translate that confidence into physical properties and millions of dollars, just as, in the wider aspect, the country itself spends hundreds of millions in the construction of railroads, anticipating the day not far distant when the towns will have become cities and the cities have assumed metropolitan proportions.

The administrative details of Ontario's road scheme have been carefully planned and the expenditure distributed wisely, so that there need be no apprehension in regard to the financing of the undertaking. It is sufficient to retain the central idea of the provincial government's [illegible] expenditure of $30,000,000 on road work and to consider the general effect of such a policy in engineering and general constructional development.

Is Upward Hydrostatic Pressure or Low Coefficient of Friction Responsible for Recent Dam Failures? [*]

It seems clear that one of two causes, or possibly a combination of the two, is responsible for many failures of masonry dams founded on rock: (1) Upward hydrostatic pressure on the base of the dam; (2) Low coefficient of sliding friction.

The theory of upward hydrostatic pressure assumes that the pressure increases uniformly from zero at the down stream toe of the dam to a pressure due to the full head of water at the upstream heel of the dam. But, upon what tests is this theory based? If the rock under the dam contains vertical fissures and is otherwise impervious, theory would indicate that the upward pressure would not exceed that due to the cross-section area of the vertical fissures. If there are also horizontal fissures beneath the dam, then the cross-section area of these also must be taken into consideration. Let us assume, however, that there are no fissures worthy of consideration, but that the rock beneath the dam is very porous, and that water flows steadily through these pores or voids. This is evidently the tacit assumption underlying the theory that the upward pressure increases uniformly from zero at the toe to full pressure due to the head at the heel of the dam. Is it not clear that if this is the case the total area of dam base is not under pressure? Are not the voids in the rock so many small pipes, and is not the combined cross-section area of these pipes far less than the area of the base of the dam? An affirmative answer seems imperative, but once this is conceded the upward pressure theory loses most of its weight.

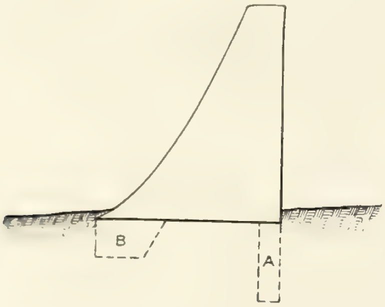

Fig. 1.

This, however, is not the only defect in the upward pressure theory. When water comes in contact with a solid, it adheres to the solid by virtue of molecular attraction between the solid and the water. In voids of capillary size this molecular force becomes of exceeding importance. It is this force, for example, that makes wet sand on a sea beach adhere so that it forms a good road, although the same sand when dry falls apart and will not support a wheeled vehicle without much displacement. What is the effect of the molecular attraction between water and the walls of capillary tubes through which it flows? Can anyone affirm that it does not greatly reduce the upward pressure on a dam founded on rock containing pores through which water flows? We know of not a single experiment that can be appealed to in answering these questions.

Here, it seems to us, is an excellent theme for an engineering student's thesis—indeed for many a thesis. At least some of the fundamental principles can be solved by quite simple experiments on a small scale. As matters now stand, engineers do not know even the fundamental principles of hydrostatic pressure of water in porous solids underlying dams.

There is an equally fruitful field for experiment on the coefficient of sliding friction of rock and earthy materials. Experimental data on this subject are lamentably inadequate, and such data as we have are based on small unit pressures. It is well known that coefficients of friction are a function of unit pressure. Hence coefficients obtained from tests under small unit pressures cannot be safely applied in cases involving large unit pressures. Yet this is precisely what engineers who design dams are doing and have done. Their factors of safety have been adequate in most instances, to protect them against erroneous coefficients of friction.

We have reason to believe that the coefficient of friction of very hard rock on its kind is greater the greater the unit pressure. But for soft rock (shale, etc.) we believe the converse may be true. We have little doubt that the coefficient of friction of clay decreases rapidly with increase unit pressure, particularly when the clay is wet. Tests should be made on a great variety of rocks and earths, dry, damp and very wet, under varying pressures up to 200 lbs. per square inch. It should be remembered that the overturning moment throws a greater pressure on the toe of a dam than that due to the weight of the superincumbent masonry. Hence the desirability of carrying the friction tests up to at least 200 lbs. per square inch pressure.

Slight jarring reduces the apparent coefficient of friction where the unit pressure is slight. Is it not likely that heavy jarring may have the same effect where unit pressures are great? If so, is it not evident that when a dam is trembling as a result of the water falling over its face, the dam may be moved by sliding more easily than when it is quiescent?

It is well known that even the slightest sliding is accompanied by a great decrease in the coefficient of friction. Hence the importance of preventing incipient sliding, entirely aside from any question as to the effect of fissuring.

A masonry dam may be perfectly safe against sliding on its base, yet the sub-base may cause failure by sliding on itself. This last is what probably happens in most cases of failure by sliding. Let there be a horizontal layer of soft shale, clay or the like, even several feet below the base of the dam, and there will be grave danger of a slipping along this plane of low frictional resistance. Hence the importance of core drilling where dams are to be founded on stratified rock, particularly where the strata are horizontal or dip downstream. The cores will show whether excavation should be carried deeper or whether a heavier dam should be designed.

Whether upward pressure or low coefficient of friction has caused dam failures is a matter of extreme importance. Those who adhere to the upward pressure theory would be satisfied with a core wall at the heel of the dam, to cut off percolation. But an engineer who regards low coefficients of friction as the cause of frequent failures would place less confidence in core walls built in rock. He would reason that capillary action would eventually result in wetting the rock sufficiently to reduce its sliding friction, in spite of the best core wall possible. He would, therefore, either increase the weight of the dam or excavate the foundation deep enough to secure a fairly deep layer of rock in front of the toe; for in the latter case he would oppose sliding not only by the weight of the dam but by the weight of a layer of natural rock below the dam.

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[*] Engineering and Contracting, Chicago.

Fig. 1 shows the difference in design that would follow the adoption of the two theories. A believer in the upward pressure theory would build the deep core wall, A, at the heel of the dam. A believer in the low friction theory would build the relatively shallow but wide wall, B, at the toe. The wall, A, would be designed merely to prevent water from flowing under the dam. The wall, B, would be designed to get a "toe hold" on the rock ledge below the dam.

This illustration will serve to indicate that the two theories must lead to radical differences in the design of masonry dams. It is highly important that tests be conducted, as above outlined, to establish to what extent each of the theories is tenable.

Cost-Keeping on Constructional Work

By G. L. Shanks

SECOND only to the ability to lead and manage men, cost-keeping is the most vital and important element in modern contracting. Granting a contractor average skill in handling men and the technical affairs of his business, his success in future contracts will usually depend on how closely his office system allows him to estimate the cost of the different elements in the work at hand. An important point to note is, that while it is often fairly easy for those in charge to study out and plan in detail a comprehensive scheme for cost-keeping on any job, it is a different matter to make the subordinates live up to the system. Most of them fail to realize the cost-analysis end, i.e., the calculation and study at certain intervals (usually every day or week) of unit costs for different items, such as mixing and placing concrete, driving piles, excavating rock, etc., and the application of these derived costs to discover and correct at once any weakness in the methods of doing the work.

The main divisions in cost-keeping on construction work are: (1)The direct charges for labor and materials, and (2) the necessary expense charges incidental to the work—often called overhead charges. These expense items, unless watched and controlled by a firm hand, are liable to total up to a large sum, and may often be the deciding factor in the financial failure or success of a contract. They include, among others:

(1) The salaries and travelling expenses of the superintending, engineering and clerical staffs on a job—also the current operating expenses of the job office.

(2) Charges for plant rental (if any), installation, maintenance, and dismantling.

(3) Building and operating a boarding camp, if there be one.

(4) Liability insurance, if any be carried.

(5) Transporting, unloading and storing construction materials—such as fuel, cement, sand, gravel or crushed stone, brick, lime, lumber and timber, piles, reinforcing steel, stone masonry, etc., etc., if the cost of these cannot be directly charged to some unit in the work, such as a pier for a bridge, or a floor for a building.

The division of the direct labor cost on a job into the different charges or sub-divisions should be done most carefully. Above all else, these charges should be practical and flexible, i.e., they should be finally decided on only after a thorough study of the actual conditions at each separate job, and they should not be so numerous as to make the system stiff or unwieldy. In short, cut the number of labor charges down to an absolute minimum, but make sure that each separate charge gives maximum service, and is sufficiently flexible so that it may be either sub-divided or expanded, if necessary. It should be constantly remembered that these cost records are kept for two main purposes: (a) As a RECORD, and for use on future work—hence they should be accurate, well arranged and easy to understand; (b) As a CURRENT CHECK on the efficiency of the work, and as a sure method of detecting any leaks or weak points in the organization or methods employed—hence they should be kept strictly up-to-date. The cost clerk or timekeeper, whose duty it is to collect and classify all this data, should have a wide practical knowledge of constructional engineering and a sound judgment, as it is sometimes necessary to differentiate carefully between various charges.

A material clerk should be held responsible for all the hand-tools and supplies on the job—his duties to include the ordering of material, the checking of the material on arrival, and the storage of same when not in use. He may sometimes include heavier items, such as heavy plant, large timbers, etc., in his work, but on large works these are usually supervised directly by the contractor himself, or by his superintendent or engineer.

There should be, as a rule, only one storehouse on a job. All hand-tools in everyday use, and all perishable supplies (except explosives, gasoline, oil, etc., which are always stored separately) ought to be kept in here under lock and key, and a careful check made of all outgoing and incoming material. Very often, in cases of emergency, supplies, tools, etc., are needed in a great hurry, and it seems hardly necessary to state that the interior design of the storehouse ought to receive careful study. The most commonly used items should be kept nearest the counter or door, and all shelves, bins, stalls, hooks, etc., should be so placed that they may be reached with the least possible motion, and the contents in or on them handled with minimum effort. These are but elementary principles to follow in order to obtain the highest efficiency, yet they are commonly disregarded.

It would be advantageous to keep two books in the storeroom: a stock book and a material charge book. The former should be a complete and up-to-date inventory of all the tools, supplies and material in use on the work, the different quantities being corrected at least daily. It may be urged that a card or loose leaf system would be just as good, if not better than a book. There is not much difference between them, the chief advantage in the use of the book being that it is more compact and affords a better chance to study and compare the variations in the use of the different items entered therein, since the stock quantity is corrected daily from the start of the job, and the amounts of the different items are all together, instead of being scattered on various individual cards which easily get misplaced.

In the material charge book all the outgoing supplies and materials (except the hand-tools, which are charged against the men using them) are charged against the different units in which they are used, such as the various piers or pedestals in a bridge, or the different floors in a building. It is not absolutely essential that entries be made in this book every day (the sooner the better, however), as the book is not usually needed until the structure is finished. Then, indeed, it is valuable.

The supply of iron rods, bars, flats, tool steel, etc., used by the blacksmith is, of course, kept by itself close to the smithy, and all that seems to be necessary with this item is to enter in the stock book every time a new supply is received, so that the working capital, as it were, is known at any time. It seems to be unnecessary to book up from day to day the comparatively small amounts used up, as the blacksmith can always be consulted as to the standing of any single item, and as to when any new supply is needed. He reports to the material clerk, each day, the quantity used and what units it is to be charged against.

With regard to pipe-fittings of all sizes, valves, etc., it would seem to be better to correct the stock book from day to day, so that a close check can be kept on the stock, and needed material ordered ahead of time—the lack of these small fittings, at critical times, often causing serious inconvenience and delay. All outgoing material is to be charged to the different charge heads as before.

Supplies in current use, such as nails, belts, spikes, washers, rope, oil, etc., should be booked up and charged out as closely as seems practicable and reasonable. Naturally, the standard of refinement on other portions of the work will govern the standard of the office work in the storeroom. For example, it would not pay to be severely economical in the use of nails, as the carpenters might thereby be induced to turn out inferior work, and yet, on the contrary, money may be literally thrown away if some vigilance were not exercised over the nail supply. The oil question is another one which might be discussed in the same way. There is a happy medium which can be reached in all these things, and although it is sometimes rather hard to educate the employees to appreciate the economical ideals of the management, it is possible, and is certainly a goal to be aimed at.

Hand-tools, rain-coats, rubber boots (if supplied at all) and similar articles which are used and kept by the men, personally, ought to be handled somewhat differently. In the stock book should be kept a list of the total stock received from time to time and supposed to be on hand. It does not seem necessary to correct the stock book any further, because all the outgoing boots, coats, tools, etc., will be charged up to the different men personally. A loose sheet or notebook may be kept to enter up daily the hand-tools, such as hammers, wrenches, peavies, crosscut saws, etc., which are taken out early in the day, or at various times during the day, and brought back in the evening. All hand-tools should be returned the same day they are taken out of the storeroom, and any not returned ought to be charged against the man taking them out.

Tunnel Construction and Ventilation for Railroads

After a general consideration for several years of the subject of tunnel construction and ventilation, the committee on roadway of the American Railway Engineering Association has reached conclusions, which have been adopted, as follows:

1. Railway tunnels, as ordinarily constructed in the United States, are more economically built by first driving the heading entirely through, but such method usually requires a greater length of time for completion of the tunnel.

2. For material requiring support the top heading should usually be driven.

3. It is economical and expedient to use an electric shovel or an air shovel for the removal of the bench where the section of the tunnel permits its safe operation; and where the material does not require support there are advantages in low cost and quick removal of the bench in driving the heading at the subgrade line.

4. Where the time limit is of value, the heading and bench should be excavated at the same time, the heading being kept about 50 ft. in advance of the bench. Where the material of roof is not self-supporting and timbering is to be resorted to, the bench should not be removed until the wall plates are laid and the arch ribs or centering safely put up.

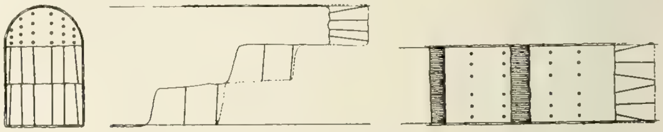

Fig. 1—V Cut for Use in Hard Rock with Few Seams

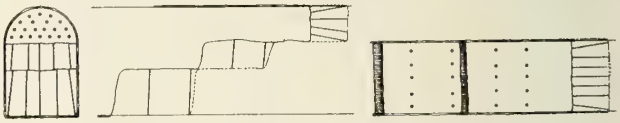

Fig. 2—Hammer Cut for Fairly Hard Rock with Seams

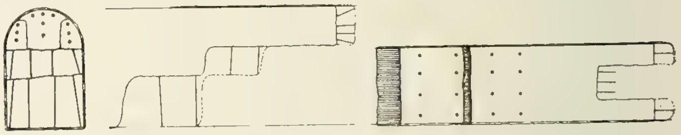

Fig. 3—Method Applicable to Soft Rock or Hard Clay

5. Opposing grades should preferably not meet between the tunnel portals so as to put a summit in the tunnel. Where practicable, the alignment and ascending grades in the tunnel should be in the same direction as the prevailing winds.

6. The accompanying drawings are representative of American practice in single-track tunnel construction, where the time limit is of value.

Explanation of Figures

The typical method in hard rock with few seams is shown in Fig. 1. The heading in material of this kind is usually driven by a V cut, using from sixteen to twenty-two holes about 8 ft. deep. The holes near the middle of the heading are drilled so as nearly to meet at the end. These holes are shot first, then the second row and lastly the outside holes. The arrangement of these holes will vary slightly, according to the way the material breaks.

The bench in material of this kind is usually taken out in two lifts of almost equal weight. The sub-bench is drilled from 20 to 40 ft. in advance of the bench.

From four to eight holes in a row, with 6 or 8 ft. face, are used in both sub-bench and bench. One or two rows of holes may be used. The center holes are shot first and the side holes last.

For moderately hard rock with seams the method outlined in Fig. 2 is employed. The heading is usually driven by a "hammer" cut, using from fourteen to twenty holes 6 to 10 ft. deep. The bottom row of holes is inclined at an angle of about 30 deg. The rows are shot in succession, beginning at the bottom. The holes should be arranged to suit the seams in the material.

The bench is sometimes taken out in one lift, but usually in two, with the sub-bench not as deep as the bench. The sub-bench is best drilled from 20 to 40 ft. in advance of the bench. From four to six holes in a row may be used with from 6 to 10-ft. face. The center holes are shot first and the side holes later.

The method indicated in Fig. 3 is used only when the material is so soft that the heading cannot be driven for the full length of timber used for the wall plates. Drifts about 4 ft. wide and 6 ft. high are driven for each wall plate, and the core is taken out as the timber rings are put in. Three or four holes from 3 to 5 ft. deep may be used in each drift. The amount of shooting necessary depends entirely upon the softness of the material, which can often be picked. The core may be soft enough to pick, or may be shot with from four to eight holes, drilled either from the face as shown or from the sides of the drifts.

In this class of material the bench is shot in one or two lifts. Only a few holes are necessary.

Tunnel Ventilation

Most practicable, effective and economical artificial ventilation for tunnels carrying steam-power traffic is to be obtained by blowing a current of air into one end of the tunnel for the purpose of removing, or of diluting and removing the smoke and combustion gases at the opposite end. As practised in America, this way of procuring ventilation partakes of two methods:

1. To blow a current of air in the direction the train is moving and with sufficient velocity to remove the smoke and combustion gases ahead of the engine.

2. To blow a current of air against the direction of the train with velocity and volume sufficient to dilute the smoke and combustion gases to such an extent as not to be uncomfortable to the operating crews and to clear the tunnel entirely within the minimum time limit for following trains.

The Administration of Municipal Public Works, Especially Relating to Highways*

By Nelson P. Lewis†

MOST American cities have a department of public works. The organization of such a department and the precise field covered by it vary in almost every city. Generally such a department has control over the preparation of city maps; street surface improvements, including grading, paving, sidewalks, maintenance, repairs and renewals; street signs and house numbers; sewers and sewage treatment; water supply and distribution, including the care of watershed, filtration, etc.; street cleaning, including the collection and disposal of wastes; street lighting; public buildings, the construction and reconstruction of surface railway tracks in streets; and the elimination of railroad grade crossings.

In cities of moderate size, say 300,000 or less, this work is usually under the more or less complete control of the city engineer, although there are conspicuous exceptions. In very large cities the organization is more complex, sometimes jurisdiction over but one or several of these activities being under a single administrative head; again, a larger group or all are under one head, but under a number of different administrative units, each with limited geographical jurisdiction. An example of the first-class is the organization provided by the first Greater New York Charter, under which commissioners of water supply, sewers, street cleaning, bridges, public buildings, lighting and supplies each had jurisdiction over the entire city, and together they formed the board of public improvements, the president of which, a separate officer appointed like the others by the mayor, had control over all topographical work. This was the charter which took effect immediately after the Consolidation Act, which created the Greater City. Everything was new. No definite policies had been established, and the results were generally unsatisfactory, although a conclusion that these results were due to the organization, instead of the chaotic condition which resulted from the consolidation into one city of a score or more of cities and villages, might not be justified.

An example of the second class is that of Greater London, where there are thirty separate administrative units, which are practically independent cities, each administering its own local affairs and raising the money which they feel they can afford to spend on the street and other services. The City of London comprises 673 acres and has less than 20,000 population. Even here, however, the London County Council has jurisdiction over certain municipal functions which are essentially metropolitan, such as the water supply, the main drainage system, the surface railway lines traversing two or more boroughs, and certain street improvements which extend beyond the limits of a single borough and which are of great importance to the entire metropolitan district.

In the present City of New York is found a combination of these two general plans. The head of each of the five boroughs has entire control of the mapping of its territory, the improvement of its streets, including the maintenance and renewal of pavements, the design, construction and maintenance of sewers, including sewage treatment plants, and of all public buildings and offices, and in two of the boroughs of street cleaning and the disposal of wastes. Other functions which necessarily relate to the entire city and where local jurisdiction would be unsatisfactory are under the control of department heads appointed by the Mayor, and they have jurisdiction over the entire city. The chief borough officers, together with the Mayor, the Comptroller and the President of the legislative body, form the Board of Estimate and Apportionment, which body has a pretty general control over all city activities, so that the City of New York comes nearer having a commission form of government than is generally realized. There always have been and there still are in the City of New York a number of special commissions. The Brooklyn Bridge was built and operated by such a commission when it was an inter-city bridge. The new East River Bridge, now known as the Williamsburg Bridge, was also built by a separate commission. Brooklyn has had the Atlantic Avenue Improvement Commission, the Shore Road Commission, and the Brooklyn Grade Crossing Commission, while the Greater City has the Metropolitan Sewerage Commission, the Board of Water Supply—having control of the development of the Catskill Watershed—and the Public Service Commission for the First District. This last-named Commission is a peculiar one. It was created by the State, and its members are appointed by the Governor, the city authorities having no voice in their selection, and while the salaries of the Commission and a few of the administrative staff are paid by the State, the expenses of the vast majority of the staff, amounting at the present time to nearly $2,000,000 annually, are paid by the city, and the chief function of the Commission is to spend money raised exclusively by the City of New York without any contribution whatever from the State, which created the Commission. Certain public or semi-public activities are carried on by organizations having no official connection with the city, but which are allotted certain funds for enterprises which would otherwise doubtless be conducted directly by the city. Among such bodies are the Trustees of the Metropolitan Museum of Art, the Trustees of the Museum of Natural History, the Brooklyn Institute of Arts and Sciences, the Trustees of the Public Library and its great number of branches, the New York Zoological Society, which maintains the Zoological Garden in a portion of Bronx Park, and the New York Botanical Society, which has the care and custody of the remainder of the same park. No enumeration of special bodies whose influence has been potent in varying degree would be complete without naming the Bureau of Municipal Research, the Citizens' Union, the City Club, and a host of civic organizations, representatives of which give the city officials the benefit of their advice on almost every subject, but none of which exercises such influence and actual power as do the three first named. None of these organizations has any responsibility to the people of the city.

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* Abstract of lecture delivered by Nelson P. Lewis before the Graduate Students in Highway Engineering, Columbia University.

† Chief Engineer, Board of Estimate and Apportionment, New York City.

New York is not alone in working through special commissions. Chicago's park system is managed through a separate commission for each park, and the results appear to have been most satisfactory. The City of Baltimore has lately established a Paving Commission, entirely distinct from the Department of Public Works or the City Engineer's office.

Then, there are the various forms of commission government, the commission in each city which has adopted this system having much latitude and the details consequently varying greatly. Perhaps the best and most efficient form of administration is that to be found in cities of moderate size, where one administrative head and the city engineer have virtually entire control. There is one serious defect which is the more pronounced in the smaller cities, and that is the practice, if not the right, of citizens to dictate to a certain degree what kind of improvements are to be made and their character. The town meeting method will answer very well for the village or the very small city, but as the city grows, as its organization becomes more complex, there is more and more need for technical skill in the planning and execution of its public works, and as the city grows the general interests of the community and the particular interest of the property owner are likely to grow more and more apart. In the small town the individual and the property he represents form a much greater relative part of the population and of the physical city than is the case in the larger city. There is no field of municipal work where the engineer has the opportunity to develop greater versatility than in the moderate sized city, corresponding, say, with cities of the second class in New York State. Here the city engineer, appointed by the mayor, is a voting member both of the board of estimate and apportionment and of the board of contract and supply. He is called upon to exercise control over almost every kind of public work incidental to the modern city. The work may not be of the magnitude to be found in the greater cities, but its variety is far greater than that which comes to the engineer of cities of the first class, where jurisdiction and responsibility are sub-divided. Having less of a certain kind of work to do, he takes it very seriously and it is often exceptionally well done. The practice of electing a city engineer by the council or other legislative body, or, as is done in some cases, by popular vote, cannot be too strongly condemned. Past experience has given good ground for the general statement that no man should be selected to do professional or highly technical work by election, whether that election be by the general public or by a legislative body. Those who are called upon to vote for candidates for such an office have no means of knowing their peculiar qualifications or lack of qualifications, and better results will almost invariably be obtained if responsibility for the appointment of a man to do much work is vested in the chief executive of the city.

One of the most fertile sources of inefficient administration and of unsatisfactory results is a divided responsibility. In the City of New York the President of each borough is responsible for the care and condition of the public streets, and yet the Department of Water Supply, the Fire Department or the State-created Public Service Commission has the right to open the pavement for the purpose of installing the underground structures without the consent, and often without the knowledge, of the officer who is held responsible for the condition of the streets. The surface railway companies must secure permission from the Borough President to open streets, but gas companies, electric light companies and telephone companies must also get permits from the Department of Water Supply, Gas and Electricity. In all these cases we have a dual responsibility which is inimical to proper control. An amusing instance of the lack of knowledge in one city department of what exists in city streets under the control of another department was afforded the speaker several years ago in the City of London. Application was made to the authorities of the City of Westminster for the right to examine pipe galleries in Charing Cross Road and Shaftesbury Avenue. There was apparently no knowledge of the existence of such pipe subways, and after extended inquiry the speaker was told that there was no subway large enough for a man to enter. Upon application next day to the Chief Engineer of the London County Council, a member of the Engineer's staff was immediately delegated to conduct the speaker through capacious pipe galleries in these two streets, while the Westminster authorities did not seem to be aware of their existence.

The following requisites are necessary in order to secure satisfactory results in highway administration.

1. Centralization of authority over and responsibility for all work to highways within the administrative district.

2. Such flexibility of organization as will permit a concentration of force on any work of pressing importance.

3. Administrative units sufficiently large to permit the utilization of an entire force and equipment all of the time, reducing overhead charges to a minimum consistent with efficiency and thoroughness.

4. Get rid of the prevalent horror of a bureaucracy. If such a bureaucracy works well, it is a good thing. If it works badly, it is not because it is a bureaucracy, but because it is not well organized.

5. Direct and undivided responsibility for every part of the work, each head of a bureau or sub-division to be made to realize, however, that his own particular work should be so done as to help and not to hinder that of other bureaus or divisions.

6. Promotion to the headship of bureaus and departments to be made from within the organization when possible, not necessarily according to seniority, but by reason of peculiar fitness. When it is necessary to go outside of the organization to fill such a place, the appointee should be one who has already made good in similar work in some other place.

7. Permanent tenure of office for those in responsible charge, so that continuity of purpose and policy may be assured.

Construction Plant and Methods Employed in Placing the Cofferdam for the New Intake Tower of the St. Louis Water-Works*

THERE is now under construction at St. Louis a new water works intake tower located in the Mississippi River, near the Illinois shore, and a 2,789-ft. tunnel leading from the tower to a screen chamber at the present pumping station at the Chain of Rocks on the Missouri shore.

The contract for the screen chamber, tunnel and intake tower was awarded in the spring of 1913 and work was started about July 20.

The difficulties of unwatering the site for the intake tower were great as it is located in from 18 to 22 ft. of water, at normal river stages, on a rock bottom which is very uneven, and in a current of 3½ to 4 miles per hour. Added to this is the fact that the river is subject to sudden and heavy rises and in winter is filled with floating ice which frequently and suddenly jams at various points and as suddenly lets go again.

The various methods of unwatering cofferdams were considered, most of them being discarded as unsuitable. Finally the method of constructing an annular caisson large enough to enclose the entire tower with several feet to spare was adopted.

The caisson is built of squared yellow pine timber, contains, altogether, 200,000 ft. b.m. of timber. It is 94 ft. long and 52 ft. wide over all, giving a space 78 x 36 ft. inside. This allows about 4 ft. space on all sides between tower and cofferdam. The caisson was partly built on four barges and was towed about 8 miles up the river from St. Louis to the site of the tower and was there completed. The caisson is shown in part plan in Fig. 1 and in vertical section in Fig. 2.

Construction work was commenced July 26, 1913, on the barges for floating the caisson and they were launched at the rate of one a week thereafter until the four had been completed. These barges were 48 x 20 ft. in plan and 5 ft. 2 ins. deep. The bow was built with a rake end or overhang of 6 ft. and the stern was square. They had one bulkhead running fore and aft in the centre. The gunwales were of 4 in. x 12 in. planks outgaged to form a caulking seam. The bulkhead was also of 4 in. x 12 in. plank without the caulking seam. The bulkhead was in the centre of the barge and halfway between it and the sides were two streamer planks thoroughly braced and tied to the cross frames. The decks were of 2 in. planks outgaged and caulked. Altogether this construction made very stiff barges and strength was requisite as they were required to withstand hard usage. Vertical sections through the barges are shown in Fig. 3 and detail of end and cross frames in Fig. 4.

When all four barges were in the water, launchways of 8 in. x 12 in. timber were laid athwartships on their decks. A sketch of the launchways is shown in Fig. 5a. These timbers were laid flatwise and reached entirely across the barges. The tops of the launchways were greased with tallow and butterboards of 4 in x 12 in. planks with lugs to keep them from slipping laterally were laid on top of the launchways. Then the barges were spaced the proper distances apart and held in position by 12 in. x 12 in. timbers bolted to the timber heads and stiffened by diagonal braces of 2 in. plank spiked to the decks of the barges and to the tie timbers.

The cutting edge of the caisson was laid down on the butterboards and both walls were carried up to the deck. The deck was then placed and the walls were carried up to four courses above it, before the caisson was towed to its final location. Figure 6 shows spacing of barges and location of caisson and the method of bracing barges apart.

The problem of anchoring the caisson was rather complicated in the swift current. Upstream the bottom was rock with pockets of sand; on the west side it was the same and on the east side it was loose river sand. The best way to provide anchorage was to drill holes in the rock of the river bottom and let in ring bolts for the upstream and the west anchors and to use concrete blocks for the east anchor.

It was too expensive to equip a boat with spuds in order to hold it steady to drill from and it was also out of the question to drill from a raft or floating boat as the current and wind would swing it from side to side in spite of anchors, while waves from passing boats would cause it to rise and fall from 2 to 3 ft. There-

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*Abstract of article by C. H. Hollingsworth, in Engineering and Contracting.

[illegible] a drill platform to rest on the river bottom was constructed. The details of this platform are shown in Fig. 7. It was composed of a concrete block with a section of 12-in. pipe imbedded in it and a timber platform fastened to the top of the pipe. The concrete block was 6 ft. square and 3 ft. thick, the pipe being imbedded in it for 2 ft. The pipe was 22 ft. long and as the bottom was 1 ft. above the bottom of the block this brought the top of the pipe 23 ft. above the river bottom when it rested on the bottom. It was braced to the concrete block by means of eight 1-in. reinforcing bars, the lower ends of which were cast in the block near its outer edges and the upper ends of which were clamped to the pipe by a heavy collar at a point about 4 ft. above the block. On top of the pipe was a standard flange and below it were two 6 in. x 8 in. timbers 6 ft. long running parallel to each other and at opposite sides of the pipe. These timbers were bolted together and bolts running down through the flange kept them from slipping down. Across the top of the 6 x 8's and spiked to them were laid 3-in. planks 6 ft. long the whole forming a platform 6 ft. square. Holes were left through the platform alongside the pipe to allow a chain to be passed around the pipe and up through platform to admit of the whole being lifted with a derrick. From the pipe directly under the platform a ladder ran down to the concrete block and was fastened securely to both pipe and block.

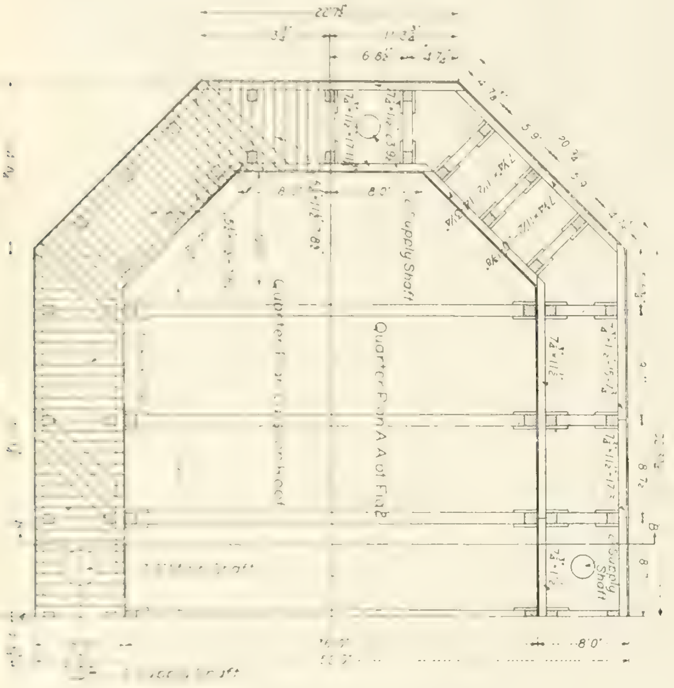

Fig 1—Quarter plans of caisson employed in constructing new intake tower of St. Louis water-works at roof and below deck.

When this platform had been assembled it was handled by a tower derrick mounted on a 30 ft. x 60 ft. barge. This derrick was intended for use in setting stone, steel, etc., on the intake tower itself. The timber tower was 30 ft. square and was set 32 ft. above the deck of the barge. It was built of 12 x 12-in. and 12 x 16 in. timbers and strongly braced. On top of this tower a combined A-frame and stiff leg derrick was erected with a 32-ft. mast and a 50-ft. boom. As the tower and derrick were set back about 12 ft. from the bow of the barge there was plenty of room in which to place the drill platform when not in use or when changing from one hole to another. The holes for the upstream anchors were drilled first and to drill them the derrick boat was anchored with the stern up stream by means of two lines running to two concrete anchor blocks previously placed. The barge was then directed into position north and south by the engineers from a base line previously established and set on position east and west by means of an instrument and a stadia rod. The barge was moved east or west until the rod reading checked with the distance which had been worked out by triangulation. Figure 8 shows a plan of the derrick barge and the method of anchoring it and the drill platform while drilling holes for anchor bolts.

The drill platform was lifted by the derrick and lowered until the concrete block rested on the river bottom. In spite of the weight of the block and platform (about 16,000 lbs.) the current would sweep it down stream a considerable distance and spin it around. To prevent this lines had to be made fast to the foot block to keep it from drifting and other lines were made fast to the ends of 2 x 4-in. pieces spiked along the sides of the platform to prevent it from spinning. When the concrete block rested firmly on the river bottom and the derrick had been unhooked, the drill, an Ingersoll D-24 machine, was set up on the platform and the drilling started. The hole in each case was started with a 24-ft. steel and when this had been run out it was followed by a 26-ft. steel. The first steel measured 3½ ins. across the bit while the second measured 3¼ ins. The length of the bolt to be inserted in the hole was then carefully measured and the hole was drilled accordingly. The depth averaged about 4 ft. and it was about 3¼ ins. in diameter at the bottom. After the drilling of the hole the ring bolt was lowered down carefully through the 12-in. pipe by means of a ½-in. cable attached to the ring. These bolts were split at the bottom and a wedge was inserted in this slot. A detail of the 3-in. anchor bolts is shown in Fig. 5b. The drill hole would break out around the top leaving a cone shaped hole about 8 ins. across the top and tapering to the regular diameter of the hole at about 10 in. below the surface of the rock. This made the entering of the bolt in the hole a comparatively easy matter except that it had to be done very quickly else the fine sand carried by the river water would fill the hole in a few minutes. After losing one hole that way, however, matters were arranged so that no time was lost in getting the bolt into the hole as soon as possible after the hole had been drilled. The drill was hoisted off the platform by the derrick which also placed the ring bolt. A piece of steel shafting 6 ins. in diameter and 12 ft. long was swung on a single or runner line from the derrick boom and after care had been taken that the ring was swung over to one side of the pipe the ram was lowered until it rested on top of the eye. It was then lifted a few feet and dropped repeatedly, driving the bolt down firmly to the bottom of the hole and forcing the wedge up into the slot and expanding the sides of the bolt tightly against the sides of the hole. In this way all bolts were set down firmly into the holes with their eyes hard against the rock of the river bottom. When the bolt had been driven home the derrick was hooked to the platform and the latter raised high enough to clear the ring of the bolt and the lines leading to the foot block were slacked enough to allow the current to drift the platform down stream a few feet when it was lowered again clear of the ring bolt and downstream from it. The diver then went down the ladder which was always kept on the upstream side of the platform and found the bolt by the simple method of getting hold of the ½-in. cable leading down through the pipe to the ring and following it to the ring. The end of this cable had previously been made fast on the barge and was left attached to the ring bolt for use as a buoy line. When the diver had located the ring bolt the end of the anchor cable was sent down to him by a hand line. This cable was attached to the anchor bolt by means of a 1½-in. shackle for the upstream anchors and a 1-in. shackle for the side anchors. A detail of the plate and shackle for fastening the upstream anchor cables to the side of the caisson is shown in Fig. 5c. When the cable had been shackled on the drill platform was lifted clear of the water, the bight of the ½-in. buoy cable caught below the bottom of the pipe, the end was allowed to run through, a buoy was made fast to it and thrown overboard and the anchor cable, which in the case of the upstream anchors was 1-in. steel cable, was coiled down on the deck of the barge.

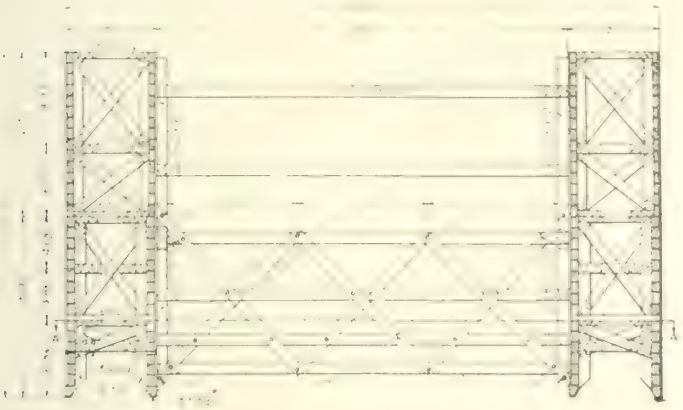

Fig. 2—Vertical section B-B of Fig. 1, caisson for St. Louis intake tower.

When the four upstream anchors had been set the caisson was towed up to position. As the steamboat pushed the caisson ahead of it, it was an easy matter to work it carefully up to the downstream end of the derrick barge, take the four anchor cables aboard, make them fast and drop back until the cables were taut. After the caisson had been anchored from these cables the side anchors were placed. The west side anchor bolts were placed as already described except that the ring bolts were 2-in. instead of 3-in. Then the anchor cables, which in this case were composed of two parts of ⅝-in. steel cable for each anchor, were taken aboard the caisson and made fast.

The east side anchors as previously stated, consisted of three concrete blocks for each anchor. These blocks were 6 ft. square and 2 ft. thick. In the tops of the blocks were two loops of 1-in. round iron for use in handling the blocks and in the side of each one was a loop of 1½-in. iron for attaching the anchor cables. The bottoms of the blocks were studded with pieces of 1½-in. square iron 18 ins. long. About 12 ins. of the length was imbedded in the concrete and the remaining 6 ins. projected so that they would catch in the inequalities of the rock in case the block settled down in the sand low enough for them to reach the former. A loop consisting of four parts of ⅝-in. steel cable and about 4 ft. long was passed through the 1½-in. iron loop in each block and a piece of 1-in. steel cable about 60 ft. long run through these short cables and clipped in a loop 30 ft. long. This was to allow of flexibility enough to enable each block to bear part of the strain and to allow them to settle to a solid bearing without in any way interfering with each other. The 1-in. cable loop was long enough so that when pulled straight upwards by a derrick barge the clips on it would be above water and so allow their removal. From each set of blocks the anchor cables were run to the caisson and made fast.

The three blocks for one anchor were placed simultaneously by setting them on edge along the front edge of the derrick barge with the bottoms facing outward and with an 8-in. x 8-in. timber held up against the 1-in. loops in their tops by the main fall of the derrick on which a light strain was kept. The steamboat pushed the barge up stream until the right location had been reached when a heavy strain was taken on the main fall and the three blocks were all dumped overboard at the same time, after which the cables were taken aboard the caisson.

Launching the Caisson

When the caisson had been built up to a point about 16 ft. above the cutting edge, sheathed and caulked, preparations were made to launch it. The timber heads coming inside the caisson were cut off flush with the decks of the barges and all bracing between barges was removed. In each of the four barges a 2-in. stop cock was placed about 2 ft. below the deck and in the sides which were turned inward. A 2-in. hole was also bored in the bottom of each of the barges directly under the hatch and plugged. A derrick barge was moored at each side of the caisson and about 75 ft. distant from it. They were held upstream by a ⅝-in. steel cable made fast to one of the upstream caisson anchors and one part of the ⅝-in. cable from each of the side anchors on that side was carried aboard the barge and made fast. Then a set of double blocks rove with 1½-in. manilla line was hooked to each of the barges under that side of the caisson and made fast aboard the derrick barge while the hauling part of this was led through snatch blocks to the hoisting engine.

When both sides were made ready in this way the lines were pulled tight on all four barges and a slight strain put on each. The stop cocks on the barges were then opened and the plugs taken from the bottom holes allowing them to sink slowly. All four barges settled at a very even rate until the decks were awash when the upstream ones settled more rapidly than the others owing to the current carrying them under. When the decks of all four barges were under water as much strain was taken on the hauling lines as the manilla rope would stand. The filling of the barges began at 4.30 p.m., October 2, and at 7 p.m. the decks were under water. A few minutes after that the [illegible]

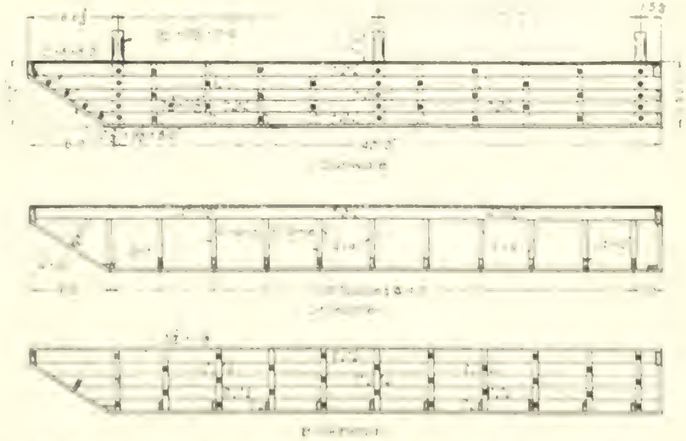

Fig. [illegible]—Vertical sections through gunwales, streamers and bulkheads of barges for floating cofferdam caisson into place, St. Louis intake tower construction.

of the timber in the caisson began to lighten the load on the barges and about 7.13 p.m. three of them slid out and bobbed up to the surface like corks. The fourth barge which was the downstream one on the east side, slid out part way and then stuck. At that corner the rock was very high in the bottom and the caisson when floating came within about 3 ft. of the bottom. As the barge was 5 ft. 2 ins. high it became jammed between the crib and the bottom when all but one corner had slid free. The other barges were all caught by the steamboat and taken ashore to be pumped out. Next morning after the slack had all been taken out of the anchor cables opposite to the refractory barge, the latter was easily pumped free and the caisson floated, drawing about 14 ft. of water which was slightly more than calculated upon. Some parts of it were not caulked up to the water surface and it was rolled first to one side and then the other and the caulking carried practically to the top before any additional timber was added. This was accomplished by placing a gin pole in each corner on the same side with their bottoms resting on the river bottom and a set of blocks leading from their tops to the top of the crib. Lines from these blocks were then led to a hoisting engine and a strain taken. This, aided by the buoyancy of the crib itself, elevated that side of the crib from 3 to 4 ft. allowing the caulking to be done, after which that side was allowed to settle down and the gin poles shifted to the other side and it was handled the same way. The construction on the caisson was then resumed and the timber carried up to about 26 ft. above the cutting edge at which time it rested firmly on bottom all around.

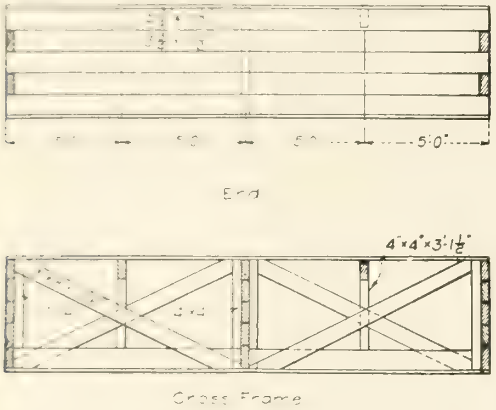

Fig. 4—Detail of end and cross frame of barges shown in Fig. 3.

The rock bottom, as before stated, was extremely uneven and the south-east corner was 3 ft. higher than the northeast corner giving the caissons a very bad twist. Also there were depressions in the bottom where the cutting edge would be from 2 to 3 ft. clear of the bottom. When the caisson had been completed up to a point 26 ft. above the cutting edge or to about elevation 89 an attempt was made to put air on it but as the only compressor on hand was one of 675 cu. ft. per minute capacity and as the twisting of the caisson had caused the seams to open up, no headway was made as the air leaked out about as fast as the compressor could pump it in. Clay filling was then dumped in the space between the walls, on top of the deck which was a departure from the original scheme which was to fill this space with sand as ballast. The clay, however, acted as ballast and in addition helped materially to stop the leaks.

When about 10 ft. of clay had been dumped in another attempt was made to put the caisson under air. While 2 or 3 lbs. of air would be registered on the gage it was still impossible to get it through the main lock which unfortunately happened to be located on the low side of the caisson. When the air had reached about 2 lbs. pressure it had forced the water down so low in the working chamber that numerous leaks were exposed and at the same time the water was not low enough to admit men through the main lock at the low side. It was decided to cut through the deck at the highest corner and place a new man lock there. In order to do this the pocket at the high point was cleaned out and pumped dry and a section of main shaft set down on the deck. Concrete was then filled in around it and allowed to set. A lock door had been placed in position at the top of the shaft section and when the concrete had sufficiently set, air from a small compressor was introduced through the 1-in. blowoff valve in the door, after two men had gone inside. The air pressure was kept at about 6 lbs. while the men inside fastened the shaft section down to the deck with 1-in. lag screws running through the flange on the bottom of it through which were 24 holes. Then a small section of the deck was cut out to allow a man to pass inside. The air was then taken off this shaft section and a second section bolted to the top to form a man lock.

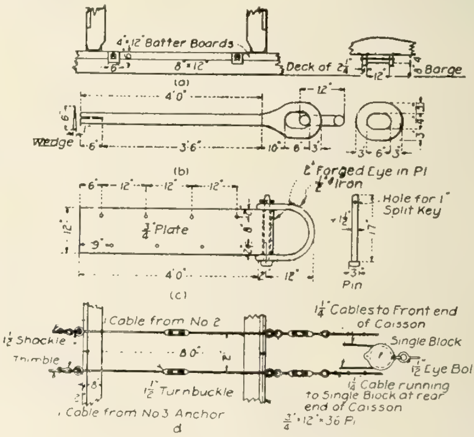

Fig. 5—Details of launching ways and anchorages for cofferdam caisson, St. Louis water intake tower construction.

One disadvantage in the concreting operations was that it was impossible to expose the rock at all points for in order to do that the air pressure would have had to be raised so high that it would have blown out under the cutting edge as much of the bottom was from 1 to 5 ft. below the latter. As the water was muddy the state of the bottom had to be determined by feeling with an iron bar, to see whether or not it had been sufficiently cleaned. When the concreting was going on the pumps were being set up to pump out inside the crib. These included a No. 6 direct connected centrifugal pump with a capacity of about 1,000 gals. per minute, one belt driven No. 5 centrifugal pump with a capacity of about 800 gals. per minute and two 6-in. steam siphons with a combined capacity of about 2,500 gals. per minute.

Unwatering Operations

When the caisson had been sealed down to the rock air was still kept on it and the pumps were started. They lowered the water level inside the crib to a point about 5 ft. below the river level after which it came back to its former level, showing that as soon as any head was put on from the outside a large leak had started. A sand dredge with a 15-in. centrifugal pump on it was obtained temporarily to see if the water could not be pumped down so we could get at the leak. This pump was rated at about 6,000 gals. per minute capacity. The dredge was tied up alongside the caisson and the suction dropped inside the latter. When this was in position it and all the other pumps were started and again the water was pumped down about 7 ft. and then it started to rise again. The pumps were kept going and a diver sent down to find out just where the leaks were.

His examination showed that the greater part of the leakage was from the west or low side of the caisson.

The pumps were again stopped and men were sent inside the working chamber to cut down through the concrete at the points where the water came through under it. This was a slow job as there was very little room to work and the concrete had set very hard. At first a hole about 2 ft. square was cut through the concrete in each of the pockets along the west side and when it was found that there was a cavity under the concrete these holes were connected by a slot about 18 ins. wide. Numerous cavities were found with boulders in them and at other places quantities of loose gravel would be found. In the former case there had been hard gravel in the holes with boulders wedged tightly together on top and to anyone sounding the bottom with an iron bar the boulders would appear the same as the solid rock. When the pressure come from the outside, however, the small gravel and sand washed out leaving the boulders in the hole.

When the loose gravel and boulders had been cleaned out the holes under the concrete were filled with a rich mixture of concrete except directly under the slot that had been cut along the center of the working chamber. From the rock up to the top of the concrete this slot was filled with neat cement making a cut off wall and the cement set up quickly. Where it was found that the concrete had been bonded firmly to the rock upon cutting the 2-ft. hole first referred to nothing was done except to refill the hole with neat cement mortar. When this had set, the pumps were again started but meantime the entire pumping plant had been changed. The 15-in. sand dredge had been taken away, and as the two 6-in. syphons used a great amount of steam for the amount of water pumped and as the rest of the plant was entirely inadequate to cope with the situation a direct connected 12-in. Morris centrifugal pump was obtained with a capacity of 4,200 gals. per minute. In addition a 5-in. Emerson and an 8-in. Emerson pump were installed having a combined capacity of about 4,500 gals. per minute.

Fig. 6. Plan showing spacing of bents and location of caisson on same, also method of bracing [illegible] apart.

In starting to pump out, however, only the 12-in. and the 5-in. centrifugal pumps were used and these pumped the water down so that the bottom was exposed in about two hours. The bottom was first cleaned of silt of which there was a deposit about 3 ft. deep and then the sand and gravel was excavated. There seemed to be some very extensive leaks after the sand and gravel had been removed as the pumps continued to handle 2,500 to 3,500 gals. per minute according to the stage of the water in the river. The leakage came in chiefly in the northwest corner and midway along the west side. This leak when uncovered proved to be a horizontal seam which came to the surface about 10 ft. inside the cofferdam and dipped rapidly so that it must have been about 4 ft. below the surface under the center of the working chamber. From this seam a vertical seam led downward about 10 ft. being 6 to 8 ins. wide. These seams could not be caulked so a bulkhead of 2-in. plank and timbers was built across the corner, grout pipes were inserted in the seams with the tops of same above water level and then the space inside the bulkhead was filled with clay and grout was forced into the pipes stopping the greater part of the leakage from that source.

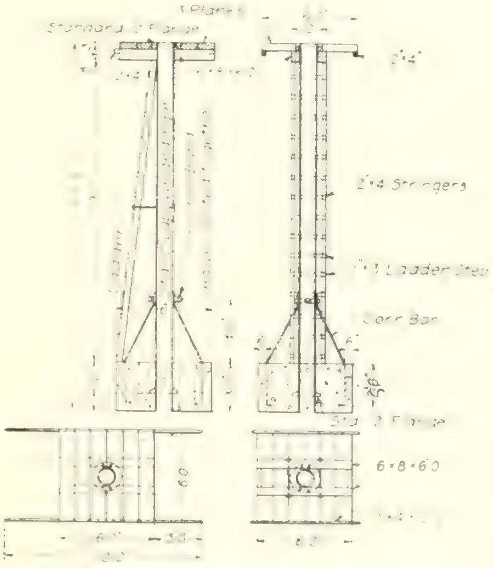

Fig. 7—Details of portable platform for drilling holes for anchor bolts on river bottom.

As the bottom rock was cleaned off, however, and the surface rock pried loose other leaks developed and incidentally the cause of the difficulty in getting the caisson sealed tightly to rock became apparent. In the rock which was a fine grained hard limestone, there were holes and watercourses worn which were tightly packed with gravel and sand and with small flat boulders wedged tightly on top.

When it was found that the pumps would handle the water without trouble the air was taken off the caisson, and the working chamber allowed to fill with water. Also the timber of the crib walls was carried to about elevation 92 and levelled up. The average water level at ordinary stages is about elevation 82. The space on top of the deck and between the walls of the caisson was filled with sand up to a point 1 ft. below the top excepting the upstream end where the filling was only carried up about 10 ft. above the deck and the remainder of the filling was done with concrete. One foot of concrete was also placed on top of the filling all the way around the caisson, bringing it up flush with the tops of the timbers. The sand filling was to give the crib weight and the concrete in the upstream end was to help withstand the blows and shocks from floating ice, while the concrete finish on top of the sand filling was to prevent the water from washing out the sand when it was high enough to run over the top of the crib. Timber heads were bolted to the upright timbers and left projecting above the concrete finish and eye bolts were placed in the sides of the crib to provide mooring places for barges.

Concreting Operations

All concreting both for the top and inside the working chamber, was mixed by hand, the gravel, sand and cement being loaded on a barge with a clear space left on the deck on which to mix. The concrete was shovelled into a bottom dump bucket and swung to the top of the crib by a derrick barge. When concreting in the working chamber the concrete was sent in through a concrete lock placed on top of the supply shaft nearest to where it was needed. There were four of these supply shafts in the caisson as shown in Fig. 1, and each of them was supplied with a bottom door of steel plate and with a long key to hold it shut.

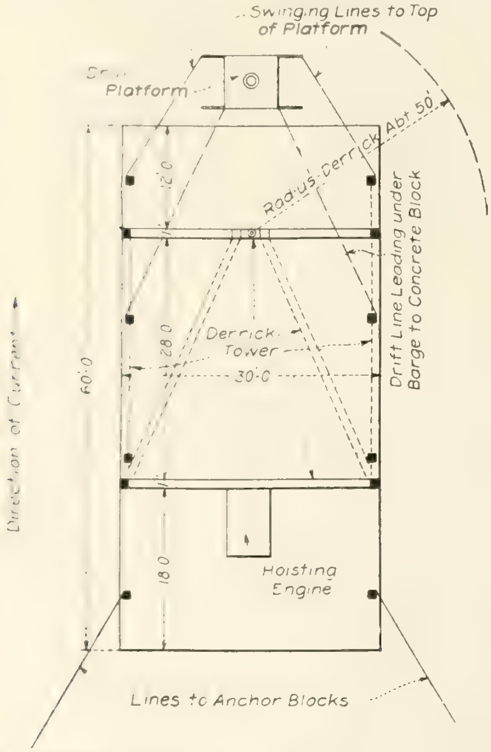

Fig. 8. -Method of anchoring derrick barge and drill platform while drilling holes for anchor bolts.

About 10,000 sacks of clay were deposited outside the cutting edge previous to starting work inside the caisson. To keep these sacks from being washed down stream by the current while they were being placed they were dropped through about 24 ft. of 24-in. supply shaft which was swung on a derrick and held with the lower end slightly above the river bottom. Several sacks were thrown down this tube after which it was raised slightly and others thrown in. When enough had been deposited in one place the tube was shifted along. By means of a sounding rod it was possible to keep close track of the location of the sacks.

When the area inside the cofferdam was cleaned out it was found that the rock bottom was from elev. 62 to elev. 64. This had to be excavated to elev. 61 and lower if the rock was not considered suitable at that elevation. It was finally excavated to about elevation 59 and cleaned up ready for the masonry of the intake tower.

The rock was drilled with Ingersoll-Rand Jackhamer drills and shot with very light charges of 40 per cent. dynamite as it was desired to shake the crib as little as possible and at the same time it was necessary to leave a perfectly sound stratum of rock for the foundation of the tower. The shooting merely loosened the rock after which it was wedged and pried up, loaded in scale boxes, hoisted by the derrick barges and dumped on the decks of barges. These barges were then towed ashore and unloaded.

When the rock had been cleaned up ready for masonry it was so late in the winter that it was considered dangerous to continue work. The work on the intake tower was therefore closed down December 29, 1913, and by January 6, 1914, all plant had been removed from the crib and from the power barge and all the floating equipment had been laid up in winter quarters.

The plant used on this work consisted of a power barge 32 x 130 ft., on which were three 60 h.p. locomotive type boilers carrying 110 lbs. steam pressure, one 675 cu. ft. per minute capacity straight line Ingersoll compressor, a 7½ kw. direct connected Allis-Chalmers lighting set (110 volt), a Smith 1 cu. yd. concrete mixer intended for use on the tower proper but which was not used on the caisson work, and a duplex pump for furnishing cooling water for the compressor and for other purposes. On this barge was also a dry house for the use of the "sand hogs" and other workers. The compressor was used for low pressure air for the caisson and later on was used for supplying high pressure air to run the rock drills. The boilers supplied steam for the compressor and for all the pumps. The power barge was moored at the downstream end of the caisson and made fast to it with steel cables. Steam and air lines on the crib and on the barge were connected through rubber hose in the case of the air and flexible metallic hose for the steam.

Two derrick barges were also used, one being the high derrick with which the anchors were set. On it was placed a Westinghouse compound air compressor with a capacity of 150 cu. ft. per minute, which supplied air for the grouting and also for the drills part of the time. The other derrick barge was a combined stiff leg and A-frame derrick with 32-ft. mast and 50-ft. boom set on a 30 x 60-ft. barge. In addition five material barges were in use.

This work is being done for the St. Louis water department. Mr. E. E. Wall is water commissioner, Mr. Gordon Black is chief engineer and Mr. E. C. Davis is resident engineer. The contractors for the work are The Fruin-Colnon Contracting Company and the Missouri Valley Bridge and Iron Company jointly, with Mr. C. H. Hollingsworth as general superintendent and Messrs. W. Naugle, R. E. Mosier and W. B. Converse as assistants on the various operations.

A hydro-electric plant is to be installed by the municipality of St. Agathe, P.Q. It is designed by Messrs. Ouimet & Lesage, Montreal, and is mainly for power purposes. The development will be on the North River and a power house of concrete will be constructed. The penstock is to be 1,000 feet long, and six feet 3-in. in diameter. The plant will be of two units of 250 h.p. each, operating under a head of 50 feet of water.

The Georgian Bay Ship Canal—Its Proposed Route and Its Economic Importance

By Sir Robert Perks, Bart.*

THROUGHOUT Canada the development of the vast natural resources of the country is almost the first consideration. How to people the prairies with healthy and industrious settlers; how and where to create new towns, giving them pure water, proper drainage, and open spaces; how to deepen, widen and bridge the waterways, and utilize the rapids and falls for the generation of electric power; the building of docks, harbors and wharves; the provision of gigantic grain elevators for storing and handling the ever-increasing crops; the irrigation of waterless lands and the creation of ready-made farms; the development of the fisheries and the exploration of the boundless mineral resources—these are problems with which Canada has to deal. But transcending all these in importance is the problem of transportation by land and water.

The Georgian Bay, Montreal and Ottawa Canal is a waterway which, when built, will connect the River St. Lawrence with the Great Lakes of Canada, and will for the first time permit ocean-going steamers of large draught to enter the inland seas, Lakes Superior, Michigan and Huron, thus gaining direct access to the Canadian and American ports which stud their shores. The construction of such a canal has for more than half a century been the dream of the statesmen of Canada.

The proposed canal is a waterway 449 miles long, formed by the Ottawa River and its tributary, called the Black River, the Mattawa River, then a series of three small lakes known as Talon, Turtle, and Trout Lakes. Here the canal crosses the watershed. The waterway thence passes through the larger lake called Lake Nipissing, and lastly continues down the French River, which discharges its waters into the Georgian Bay on Lake Huron. It will be seen by the map that this waterway utilizes for the greater part of its route a continuous chain of natural and existing lakes and rivers. Of this long waterway, 332 miles are a natural waterway 300 feet wide and over 22 feet deep.

Passing up the Black River, a distance of 27 miles, the steamers will be lifted at two locks and enter the Lake of Two Mountains, which is 20 miles long. The canal continues along the Ottawa River to the city of Ottawa, passing the towns of Oka, Point Fortune, and Hawkesbury, a distance of 129 miles from the entrance on the St. Lawrence. Upon this section the steamers are lifted up at two further locks to a total height of 140 feet above the level of the St. Lawrence. At Point Fortune and at Hawkesbury there are water powers capable of generating 278,000 horse power electric power. The whole of this electric power will be readily saleable at remunerative prices in the cities of Montreal, Ottawa and Hull, or to the factories which will be established, and the towns which will spring up along the route of the canal. The total electric power generated along the canal by the use of water power is estimated at nearly 1,000,000 effective horse power. This power will be used for lighting, traction and manufacturing purposes.

The total number of locks on the Georgian Bay Canal will be twenty-three—namely, three on the French River on the west side of the summit level with a fall of 70 feet, and twenty on the east side between Lake Nipissing and the St. Lawrence, where there is a fall of 633 feet from the summit over a distance of 357 miles.

The locks will be 850 feet long, with a width of 65 feet, and a depth of 24 feet of water on the sill. For many years the tendency of the steamers navigating the Great Lakes has been steadily to increase in size. In 1902 the largest vessel navigating the Great Lakes was 478 feet long, with a draught of 20 feet, and a carrying capacity of 8,500 tons. At the present time the largest ship is 617 feet long, with a capacity of 13,000 tons. The value of the steamship tonnage trading on the Great Lakes is estimated at £35,000,000. Eighty per cent. of this tonnage is American owned and American built. For four months of the year this immense capital lies in the ice-bound lakes. After passing the city of Ottawa, and the busy manufacturing towns of Hull on the opposite side of the Ottawa River, the canal continues up the Ottawa River, past the towns of Arnprior and Pembroke, till it reaches the Mattawa River. Continuing thirteen miles up this river, and ascending the Paresseux and Les Chines Falls by a series of five locks, the canal enters three small lakes called the Talon, Turtle, and Trout Lakes. It is proposed to lower these lakes to the level of Lake Nipissing, making a cut through the summit level for a distance of five miles. This section will be cut through the Laurentian rock.

Sir Robert Perks, Bart., who is now visiting Eastern Canadian cities.

At North Bay, on Lake Nipissing, extensive wharves and grain elevators will be constructed, and the canal will be widened to double width. At this point the main lines of the Canadian Pacific from Ottawa and the Grand Trunk Railways from Toronto converge and cross the canal. From Lake Nipissing the canal drops down the French River, a distance of eighty-three miles, by three locks. On this section there are two water powers, capable of generating

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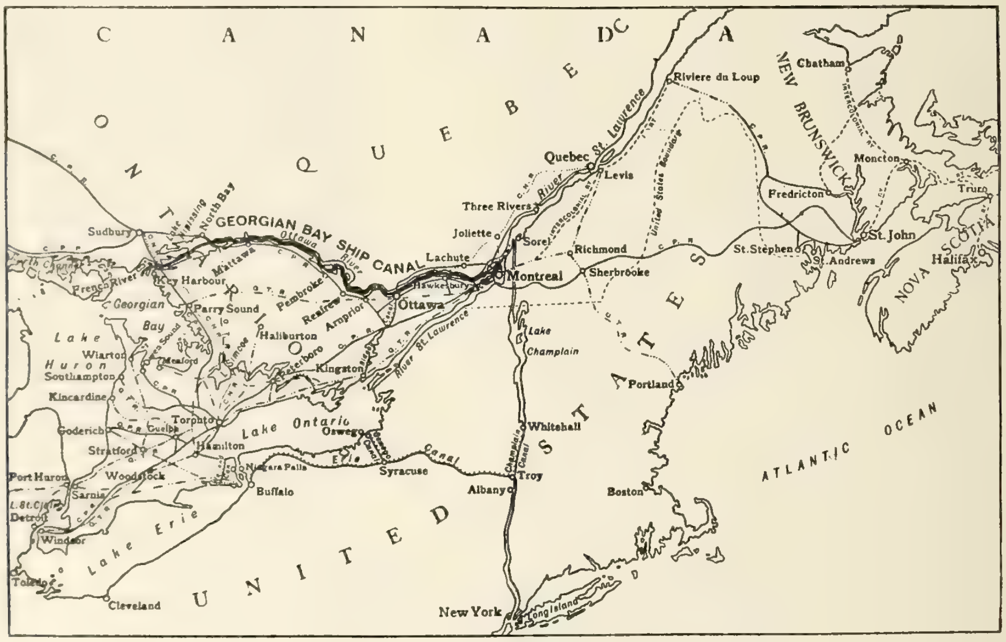
* Writing in the Journal of the Royal Society of Arts.

20,000 horse power. At the mouth of the French River the steamers enter Georgian Bay, one of the arms of Lake Huron, and then have a clear course to American and Canadian ports on Lakes Michigan and Superior.

Chicago and Milwaukee have together a population of nearly three million people. Their export trade is immense. By the Georgian Bay Canal route they are brought 412 miles nearer to Montreal than they now are to New York by the Erie Canal route, and they become 794 miles nearer to Liverpool than by Buffalo and the Erie Canal. What is of even greater importance, there is by the Georgian Bay Canal route water carriage all the way from Chicago to Liverpool or London, and grain goods may be sent without break of bulk direct to Europe. Fort William and Port Arthur will be brought 282 miles nearer to Montreal by the Georgian Bav route than by the Welland Canal and St. Lawrence route.

The time taken to make the journey through the Georgian Bay Canal will be 70 hours for the 449 miles. This is a little more than the distance from London to Edinburgh or Glasgow.



Proposed route of the Georgian Bay Ship Canal.

Various estimates have been made of the cost of constructing the canal. The works would probably take seven years to complete.

The cost must always depend to a very great extent upon the price of four main items at the time the works are built. These items are, land, labor, material and money. It will be safe to say that the cost, excluding the payment of interest during construction, and also excluding the cost of building the electric power houses, which will be erected as the demand for power arises, will be well within $150,000,000. The estimate of the Canadian Government is about $120,000,000.

The revenue of the canal will arise from the carriage of wheat, corn, and other cereals from the West; of timber and forest products, including pulp and pulpwood from the forests opened up by the building of the canal; of coal, iron, and other minerals; building material and general merchandise which cannot be carried profitably by rail. It is calculated that this traffic will amount to a total of at least 18,000,000 tons a year. The revenue from such tonnage, estimated at 50 cents a ton, will be $9,000,000. Deducting the working expenses of $1,000,000, there will be a net return of 4½ per cent. upon an outside cost of $150,000,000. The financial advantage arising from the building of the canal to the general trade and commerce of Canada will far exceed the direct results to the owners of the canal.

There has recently been completed at New Hazelton, B.C., a highway suspension bridge with a centre span of 451 ft. and a total length, including approach spans, of 600 ft. The bridge, which has a clear width of 9 ft., crosses the Bulkley River gorge, and is about 250 ft. above the water. The towers supporting the suspension cables are 65 ft. high, and are constructed of fir timbers. One of the towers rests on a concrete pier, while the other is on solid rock. The floor of the bridge consists of 3 x 4-in. fir plank, laid on 4 x 7-in. stringers, which rest on steel supporting pieces. The cables consist of Cradock's locked coil steel wire rope, 2½ in. in diameter. Each cable has an ultimate strength of 350 tons, and is anchored by means of two 3-in. steel bolts into blocks of concrete which weigh approximately 150 tons. The bridge has steel stiffening girders, designed to carry a moving load of 18,000 lbs. The suspension rods, which carry the floor system, are ¾ in. in diameter. They are spaced 4 ft. apart, and are fastened to the cable with clamps. The bridge was designed and erected by an English company, all of the steel parts having been imported from England. The length of time required in actual construction was about two months. The bridge is in a practically undeveloped section of British Columbia, and is at the site of a primitive wooden cantilever structure which was built many years ago by the Indians.

The master painters of Montreal have decided not to grant the increase in wages asked by the local union. The masters are of opinion that the present scale is high enough, and they are determined to maintain the principle of the open shop, paying each man according to ability. Last year an increase of 10 per cent. was voluntarily made.

Systematic Refuse Disposal for Small Cities and Towns

By Samuel A. Greeley, Consulting Engineer, Winnetka, Ill.

IN most communities with populations of less than 50,000, systematic methods of garbage or refuse disposal are not yet practised. In residential communities of less than 30,000, it is not uncommon to find three or four local scavengers making collections of house refuse from the wealthier residents comprising from one-fourth to one-third of the total population. These scavengers dispose of the house refuse so collected in very unrestricted ways. Part of it is dumped on waste lands, part of it is fed to pigs or chickens, and occasionally part of it is burned. The larger portion of the population, from whom no collections are made, dispose of their house refuse on their own premises or on adjacent vacant lowlands.

In cities with populations ranging from 30,000 to 50,000 a more extensive collection system may be found. It is, however, very unusual to find a comprehensive municipal service. In many of the smaller cities of Ohio the refuse is collected by contractors at a charge of ten cents per family per week. These contractors frequently burn the garbage and combustible refuse, dumping the remainder. This method is costly when compared with the annual cost for the service if the work is done by a city department. Where each householder pays directly to the contractor for the cleansing work, there are many families who do not consider the service sufficiently important to warrant the cost. They, therefore, oftentimes cause discomfort to their neighbors and endanger the health of the community by affording opportunities for flies to breed.

The disposal of manure in small communities is, fortunately, more easily accomplished than in larger cities. The farming areas are within easy hauling distance, and the manure is taken quite promptly to the farm on account of its fertilizing value. There are times, however, during the summer season, when the farmers are busy with their crops, that the manure is not removed as promptly as desirable.

This common condition in smaller communities, coupled with the growing desire for better community sanitation, has led many of the smaller towns to seek for better methods of refuse disposal. Garbage, ashes, dry rubbish and stable manure are the chief materials requiring removal and disposal. The first step generally taken by towns seeking to improve their methods of refuse disposal is to build a garbage crematory. Very little consideration is given to the best means of house treatment or of collection, or to other methods of final disposal. Not long ago I was called in to advise a town of about 5,000 inhabitants on the question of building a garbage crematory, to cost, including land and engineering expenses, approximately $20,000. Upon investigation, it was discovered that the collection service was reaching only about 25 per cent. of the people, so that the expense for the crematory would have benefited only a small part of the population. It was my recommendation that available funds be spent for improving and increasing the collection service, and until the collection service had been developed to include practically the whole town, that the house refuse be buried in a proper and scientific manner. In another instance I was called in to advise a town as to which of four bids received for a garbage crematory was the most advantageous. Upon examination it appeared that the bids had been submitted upon the city's specifications, requiring a plant of 12 tons capacity per 24 hours and a chimney 150 feet high. That was the extent of the specifications. The bids ranged from $8,000 to $30,000. It was manifestly impossible to make a satisfactory award, and the securing by the city of an adequately designed and properly built plant was doubtful under these conditions.

In view of these facts, it is worth while to consider what points should be included in proper measures to be adopted for improvements in refuse disposal in such towns.

House Treatment of Refuse

It would first seem proper to consider the best method of caring for the refuse at the point of production. House refuse should be kept in good metallic cans of such size that they can be easily handled by one man. In very small communities—with populations of 5,000 or less—ashes can ordinarily be disposed of near the premises, so that it does not seem advisable to place all classes of refuse in one receptacle. By separating the garbage the bulk to be removed is smaller, the disposal by burial requires less land, much of the garbage can be sent to farms for feeding to pigs, and the general cost of refuse disposal is reduced without seriously lowering the efficiency. In cities of from 30,000 to 50,000 the mixed refuse system, requiring only one can at a house and permitting incineration without the use of additional fuel, has many advantages. It is simpler for the householder; it results in cleaner cans; it is cleaner to handle in collection wagons, and affords less opportunity for flies to breed. In such small cities garbage does not have the value for reduction purposes that it has in the larger cities, because the cost of handling at the reduction plant when distributed over such small quantities of garbage is prohibitive

One feature of the house treatment which is troublesome in smaller towns, comes from the tipping over of the house can by dogs. Wrapping each day's production of garbage in an old newspaper and placing the bundles in the can have largely reduced this trouble in places where it has been tried. Wrapping the garbage also keeps the can clean, reducing the attraction for flies, and is well worth consideration. It cannot be used if the garbage is fed to pigs, and would add a certain cost to the burial of garbage, but is most desirable if the garbage is to be burned.

Collecting the Refuse

The collection of refuse in small communities is, perhaps, that part of the general problem through which the greatest improvement can be effected. The most important elements of the collection service are:

(1) Frequent and regular collections.

(2) Intelligent drivers, who are willing to take pains to do the work at each house in a cleanly fashion.

(3) Properly selected collection wagons, kept clean and well painted

It is surprising to what extent the design of the collection wagon affects the cost and efficiency of the results. The wagon should be as large as is consistent with local grades and roads. The loading height of the wagon should be at a convenient distance from the ground, so that the collector can easily empty the can into it. The arrangement for unloading the wagon should be quick and simple. Bottom-dump wagons are the best, but cannot be used for raw garbage unless it is wrapped, because the bottoms are not waterproof. It is serviceable for mixed refuse. The rear-dump wagon, tilted by a hand-turned gear at the front, has given success in practice. The method of covering the wagon is especially important. I think the most satisfactory covering is a tight fixed roof, arched over the top of the wagon at sufficient height to give a free space above the level of the garbage in the wagon and to allow trap doors in the side of the wagon for emptying the can. Wagons of this type are in general use in Germany. Wagons having capacities of about three cubic yards are desirable.

Final Disposal of Refuse

It is frequently the case that in small quantities the disposal of house refuse receives more attention than it deserves. If the garbage is removed promptly and regularly from the house to some isolated point of disposal, and proper attention is given to the upkeep of this point, there are several methods for disposal available. The garbage can be buried in the ground, be fed to pigs or burned. The burial of garbage is quite satisfactory if properly done. It requires skillful attention. It depends upon aerobic bacterial decomposition for its accomplishment. Therefore, the garbage must not be placed so deep that the air cannot penetrate, and the area of garbage must not be more than the soil bacteria can reach and digest. When these two factors are observed, the burial method is the simplest and most fool-proof available.

Feeding garbage to pigs is also a satisfactory method of disposal, if properly done. Feeding troughs and pens for the pigs much be made up so that they can be washed and kept clean. About 75 pigs are required to dispose of one ton of garbage per day. Nuisances will arise from piggeries of this size if they are not kept clean. There should also be some method of sorting the garbage before feeding it to pigs, so that stale garbage may be discarded and buried or burned. In some places it has been found expedient to disinfect the garbage by boiling it in large cauldrons before feeding it to the pigs. In such cases the cooked garbage is commonly used only as a base for the feed given to the pigs. The method is a most profitable one, and warrants consideration in small cities where isolated farm sites are available.

The disposal of garbage and other combustible refuse by incineration is accomplished in specially designed furnaces, and if the garbage is mixed with sufficient ashes and rubbish the resulting material will contain sufficient carbon to be combustible. Frequently, however, in small towns, it is desirable to burn the garbage by itself. Garbage alone is not combustible and requires an additional fuel. Garbage crematories require careful design and good construction to insure satisfactory and durable results in operation. A plant of this sort—when properly carried out—can, however, be located quite centrally without creating a nuisance, this reducing somewhat the cost of collection.

Garbage crematories to burn garbage with some rubbish, manure or night-soil are the commonest type of furnace in small communities. They consist of a feeding platform on top, below which is a drying hearth of brick. This hearth receives the wet fresh garbage charged into the furnace. Below the drying hearth are fuel grates on which coal is burned with the dried portion of the garbage. The drying hearth with the wet, cold garbage above and the hot coal fire below is in a critical position and deteriorates rapidly if not properly built and designed. Some furnaces are built with a secondary coal grate near the chimney to consume the unburnt gases of combustion. These grates are often neglected and not used. Crematories can be operated by forced or natural draft. A high chimney and strong natural draft is good practice. The coal required amounts to upwards of 200 pounds per ton of garbage, depending upon the efficiency of combustion required by the community and the character of the garbage and other materials burned. The cost of construction will range from $600 to $1,000 per ton daily capacity. The cost of operation will range from about $1 to $1.50 per ton, but local conditions may alter these limits.

In some towns gas garbage burners have been installed by private individuals in their kitchens. These will cost about $3 per month to operate for one family and will not be wholly free from nuisance. They are useful where dumping or burial is difficult and there is no adequate municipal service.

These considerations should indicate clearly the advisability of tackling the refuse disposal problem scientifically in order to get the best service for a reasonable expenditure.

Sanatorium at Fort Qu'Appelle, Sask.

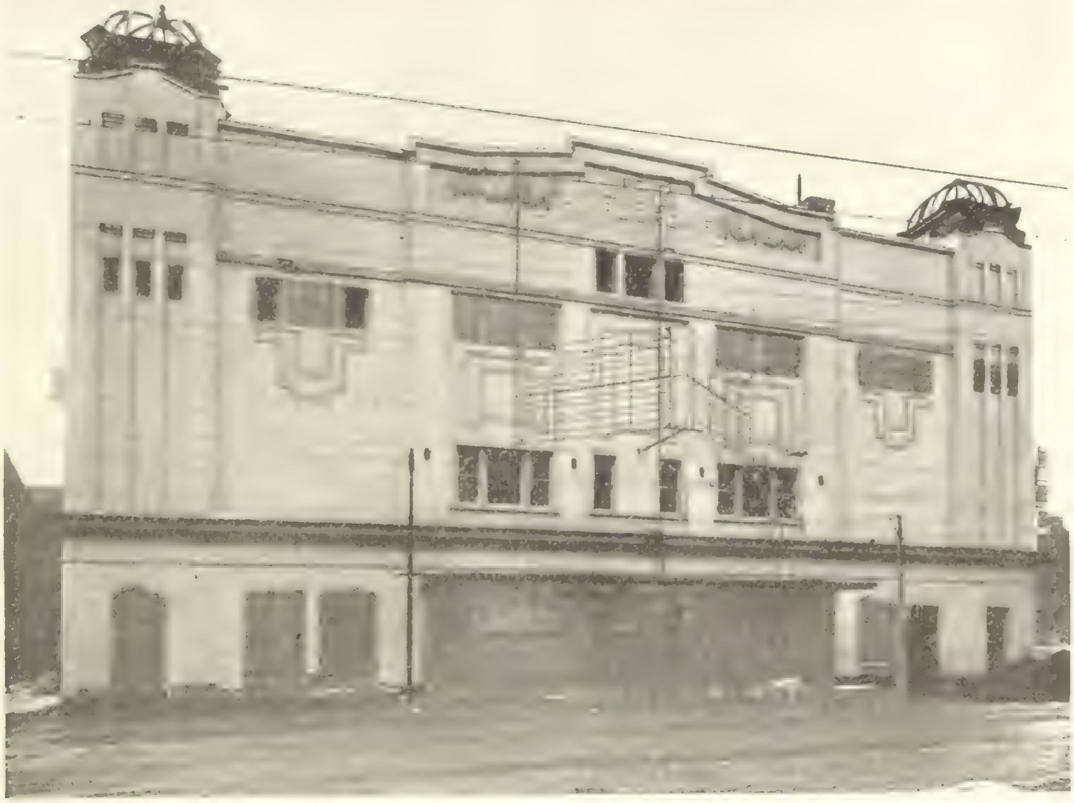
THE Saskatchewan Anti-Tuberculosis League are constructing a sanatorium on the north shore of Echo Lake, one-and-a-half miles west of the village of Fort Qu'Appelle, Sask. The structures to be erected this year are the Administration Building, Superintendent's residence, Power house and two nurses' cottages, and the lay-out has been so arranged that additional cottages may be erected at any time in the future. These buildings, when completed, will cost in the vicinity of $220,000.

The Administration building is three storeys high, of reinforced concrete and brick construction. It has a frontage of 140 feet, and a depth of 32 feet with a 63 feet wing on the back. The Superintendent's residence has two storeys. It is 38 feet by 35 feet in size, with frame construction and stone basement. The two nurses' cottages are each 100 feet by 31 feet, with two storeys. Like the Superintendent's residence they are frame buildings with stone basements. The power house is 88 feet by 52 feet and is constructed of brick with steel roof.

Underground tunnels, 4 feet by 5 feet, run from the power house to all the other buildings, and the water pipes, electric wires, etc., will run through these. The water is to be pumped to a reservoir placed upon the top of one of the high hills at the rear of the buildings, and from thence it will be piped to each building.

The architect is Mr. J. H. Puntin of Regina, and the contractors are the Parsons Construction & Engineering Company, Limited, of Regina.

The completion of the Lower Bari Doab Canal, the third section of the triple canal project in the Punjab, proves the greatest enterprise ever undertaken by British irrigation engineers. This canal is unusual in construction, in that it actually crosses upon a level the important River Ravl. The new waterway has cost about $7,500,000, and it is expected that it will irrigate over 871,000 acres of crop.



Shea Theatre Company's New Hippodrome which is now nearing completion at Toronto.

Structural Features of New Toronto Theatre

(Staff article)

THE last word in theatre construction may be said to be embodied in the new Hippodrome which has just been erected for the Shea Theatre Company of Toronto. The building, whose graceful facade adorns the south-west side of Terauley street, has a frontage on Terauley street of 111 feet. It is built of steel, reinforced concrete, tile and brick throughout, and is completely fireproof in every part. The side walls and back of the building are faced with gray stock brick. The exterior on Terauley street is finished in white enamelled brick and hollow tile porous terra cotta, and on either corner of the structure are towers of glass with copper framework. A massive copper marquee extends the entire length of the 46-ft. entrance and the whole width of the sidewalk. In the construction of the theatre over 550 tons of steel and iron have been used for the structural work alone, while a great quantity in addition has been used for the stairs, fire escapes and other equipment. Underwriter standard fireproof doors and a complete sprinkler system, with the usual arrangement for standpipes at every necessary point, have been installed as additional precautions against fire. On either side of the building wide fire escapes have been erected, with numerous exits leading thereto and to the passageways at both sides of the building. The fire escapes instead of landing on the areaways, as has been the custom in the past, lead into fire towers set within the building line. In this way they remove from the areas at the sides of the building all possible obstruction to free egress.

The balcony is built on the new system of cantilevering that has but recently come into general practice. It has an overhang of 67 feet. The cantilevering rendered unnecessary the erection of obstructive columns on the first floor. The dimensions of the auditorium are 111 feet by 125 feet. The theatre will have a seating capacity of about three thousand, divided equally between the orchestra and the balcony.

The auditorium proper is separated from the exterior walls by spacious lobbies at the sides. These lobbies serve the useful purpose of promenading space and also prevent the possibility of cold air entering the auditorium through the side exit doors. These vestibules will be connected direct with the private boxes as well as with the orchestra floor and balcony, and at the same time will have safety exits direct to the areaways at the sides of the building. The ceiling under the balcony has been lowered and the space between it and the balcony floor is converted into a commodious mezzanine reached by two marble stairways, each 9 feet wide, located at either side of the lobby. The rise to this mezzanine is comparatively slight and from it the public enter on the level, thus rendering unnecessary a tedious climb to the balcony itself.

The mezzanine is fitted with a large parlor for the ladies and a smoking room for the men, both of which face Terauley street, and these apartments are fitted with large windows. The mezzanine being so centrally located between the two floors of the theatre will prove one of the chief attractions of the new hippodrome

On the first floor is located a still larger parlor for the ladies, taking up the entire frontage of the building at one side of the lobby. In the basement is also an additional smoking room reached from the rear of the auditorium by a short flight of stairs. This room has windows opening on the side area. The lobby is 46 ft. wide and handsomely decorated in the prevailing tones of the theatre proper. The main ceiling of the auditorium and the ceiling of the orchestra under the mezzanine are beautifully panelled and beamed with ornamental plaster work. The private boxes and proscenium arch are as elaborate and artistic as modern ideas can make them. A massive dome in the main ceiling, illuminated by indirect lighting, adds greatly to the pleasing effect of the auditorium. The prevailing colors of the decorations are creams, rich golden tone and soft grays, with the ornamental relief work finished in old ivory and brilliantly gilded. The sounding board is enriched with handsome Mural paintings.

The proscenium girder which spans the stage opening is 50 feet in length and weighs 16 tons. The fact that some of the cantilevers weigh 25 tons conveys some idea of the heavy steel work used in the structure. The six dressing rooms are located in three tiers at the sides of the stage and are separated from it by a fire wall in strict conformity with the most modern ideas and requirements. The partitions are of terra cotta 6 in. and 4 in. tile. The flooring throughout is of concrete, and the roof is of Barrett specification. The doors and casings of the entire building and the wainscotting of the auditorium are finished in a rich mahogany. The lobby is wainscotted in marble and with the marble columns in the auditorium, the finish of the walls and ceilings throughout lend a pleasing appearance to the whole.

The entire building is heated and ventilated in the most modern and approved manner. The lighting scheme was carefully thought out by the architects, and both direct and indirect systems of lighting have been installed.

Construction was begun in May, 1913, after excavating, and the theatre will be opened to the public during the present month. Apart from the cost of building space the structure involves the expenditure of about $250,000.

The architects were Messrs. Leon H. Lempert & Sons, Rochester, N.Y., with whom was associated Mr. C. J. Read, architect, Toronto. The general contractors are Messrs. Fred Holmes & Sons, Toronto. The steel work was carried out by the Dominion Bridge Company, having been designed by Mr. F. Meister, engineer of New York. The Sun Brick Company of Toronto supplied the stock brick for facing the side walls, also a considerable quantity of the backing-up brick. The York Sandstone Brick Company and the Toronto Brick Company furnished a large quantity of brick for interior work. The ornamental plaster work was done by the firm of Maltby, of Corning, N.Y.; plain plaster work, Mr. E. J. Currie, Toronto; ornamental iron, stairways and fire escapes were supplied and erected by the Dominion Ornamental Iron Company; the painting was done by Mr. W. M. Weekes, Toronto; the Mural decorations were carried out by Mr. Geo. Brande, Chicago; the fireproofing was supplied by Mr. E. D. Hoeffler, of Buffalo; roofing and sheet metal, Douglas Brothers, Toronto; plumbing, heating and ventilating, Mr. Fred Armstrong, Toronto; carpenter work, Mr. A. B. Coleman, Toronto; electric wiring, etc., the L. K. Comstock Company, Toronto and New York; electric fixtures, Messrs. MacDonald & Willson, Toronto; terra cotta, the Atlanta Terra Cotta Company, New Jersey; enamelled brick, American Enamel Brick Company of New York; and the marble and terazzo was supplied by the Lautz-Dunham Company, Limited, Toronto. The chairs were supplied by the American Seating Company.

How Bridges Expand

THREE years ago I made a series of observations of steel railway bridges erected on various lines of the New York, New Haven & Hartford Railway, to determine the action of the expansion bearings, says a writer in the Engineering News. The bridges on which the observations were made are all relatively new, having been erected during the past ten years. In all, 45 observations were made, on as many different bridges. Of these 16 were pin-connected trusses, varying in length from 182 to 217 feet; 11 were rivetted through trusses, 70 to 145 feet in span; and 18 were deck plate-girder bridges, 70 to 111½ feet in span. The winter temperatures during which observations were made (1910-11) ranged from + 15 to + 56 deg. F., and the summer temperatures (the following summer) ranged from 45 to 86 deg. F. The variation from high to low temperature during a single set of observations ranged from 18 deg. change as a minimum to 54 deg. change as a maximum.

To complete the coefficient of expansion, it was necessary to know the temperature of the bridge at each observation. It might be thought that very precise temperature readings would be necessary, but the following observation indicated that this was not the case: a 217-foot pin-connected truss span was watched while the atmospheric temperature was rigidly rising under the warm rays of the morning sun. It was noted that a movement occurred at the roller bearing for every 3 to 5 deg. F. rise in temperature, and whenever such a movement occurred there was a loud noise. The bridge and its bearings were in good condition. It is concluded from the observations that, even under nearly ideal conditions of free movement, the expansion movement of a bridge does not take place smoothly and continuously.

A mine-fire gallery has been built by the U. S. Bureau of Mines at its Pittsburgh experiment station. This is a steel tube 6½ ft. in diameter and 27 ft. long, laid in a deep trench, lined with firebrick and mineral wool, covered with 2 ft. of earth, and with its ends stopped by 13-in. brick walls. The chamber has been made as nearly air-tight as possible and insulated against the escape of heat generated within. At one end is a motor-driven fan and air meter, while at the other is a stack which can be opened or closed. At intervals along the top of the gallery are small pipes for withdrawing samples of air or gasses inside, or for inserting pyrometers. The gallery will hold six to eight tons of coal when one-third full. It is intended to place different kinds of coal or waste in the chamber and study spontaneous developments under various conditions. Experiments are planned on controlling fire by reducing air supply or sealing. Progressive changes in composition of the gases, etc., will be followed out and temperature measurements made to secure data for solving practical problems in subduing mine fires. It is claimed that this is the first attempt to investigate this problem with experimental apparatus on a mining scale and with full control of surrounding conditions.

General view of Kilgard Fire Clay Company's plant at Kilgard, B.C. Note immense mountain of raw material in background.

The Kilgard Fire Clay Company's Plant at Kilgard, B.C.

(Staff Article)

THE works of the Kilgard Fire Clay Company, Limited, are situated in British Columbia at Kilgard, in Sumas municipality, adjoining the international boundary line. Kilgard is located on what is at present a branch of the Great Northern Railway, but which will eventually be the main line of the G. N. R. between Spokane (Wash.), and Vancouver, B.C. The plant site is on the southeast side of Sumas Mountain, about 65 miles distant from Vancouver. The company have erected a large boarding-house to accommodate 140 men, a store and several cottages and a small school house. They have secured a small library from the provincial government, and are doing all they can to make their employees comfortable.

A small reservoir has been built on the mountain directly behind the town which supplies water for the works as well as for the town. It is possible to secure 160 pounds pressure in case of fire.

Nature has provided an inexhaustible clay supply in Sumas Mountain—ranging in quality from the highest grade fire clays to the red burning vitrifying shales. The clays lie in horizontal strata behind the factory. The lowest is slightly above the plant so that there is gravity haulage in all cases. The strata vary in thickness from six feet in the fire clays to sixty feet in the upper shales. In nearly all cases there is a hard overlying material which provides a good roof for the mining.

A main gravity 3-rail tram line is located directly behind the factory leading from the crusher up to the storage bunkers. The storage bunkers are placed above the tracks at points conveniently located for the mines. The tram line is twelve hundred feet long, and has a 16 per cent. grade at the top which gradually decreases to 4 per cent. at the bottom. There is a passing track at the centre point. As the system is a three-railed one, the passing track requires no automatic switch. It has been found after a year's operation that the system is in every way satisfactory. The variation in grade may lead to the belief that it would be difficult for the loaded cars when they were running on the 4 per cent. grade to pull the empties up the 16 per cent. grade. This is not the case, however, as the low grade is at the low end of the system, and sufficient momentum is gathered when the loads are on the 16 per cent. grade to carry the cars to the crusher or low end. The clays are delivered from the mines to the storage bunkers on the tram line in several ways. Three mines are well above the tram up a steep hill. The clays are dumped into a chute and slid down to the bunkers. The chutes are 33 per cent. grade and steel lined. Heavy bumper doors are located at intervals in the chute to check the speed. These are hung on hinges from above. The bunkers are so arranged with inclined bottoms and doors that the clay is easily dumped into the cars on the tram line. One man can operate the system with ease and has handled at the rate of 600 tons in ten hours allowing 10 per cent. for loss of time.

One of the best features of this method of clay delivery is its adaptability to making mixtures of clays. Should it be desired to make a mix of fifty per cent. of two clays, one bunker being at the head of the tram line and the second bunker at one-third of the way down, the operator will fill one of his cars at the upper bunker and then lower the two cars down to the other bunker, where a second man will fill the second car with this clay. There are two cars on each track these two cars being transferred down to the lower end of the line and dumped into a hopper above the crusher. While the cars are being dumped one of the empties at the upper end is being loaded. Side dump cars are used. The variation in the tram grade lends itself to this method of mixing clays, as there is only one loaded car from the upper bunker down to the bunker where the second car is filled, and it and the second car (which is empty) have to pull the two empties back from the foot of the line. During this first half of the trip one load is going down the 16 per cent. grade while the two empties are coming up the 4 per cent. grade.

(For a full description of this system see the Transactions of the American Ceramic Society, Year 1913, article by Mr. E. H. Riddle).

After the clays are crushed they are elevated and delivered to the storage bins in the factory to be ground. When the clays are mixed on the tram line it is easy to see how thoroughly mixed they are at this stage. There is little chance for error in the mixing process, as it is not likely the tram operator would forget to fill his second car at the halfway bunker. The old method was to mix the clays in the factory storage bunkers in small lots, by shovels, etc., employing unskilled men who worked in an out of the way part of the mill. The cost was not only heavier, but chances for error were much greater.

The Plant

The plant is located at the edge of the mountain with a rather steep grade at the rear and a slowly sloping yard at the front, which affords plenty of space for the kilns and yard storage. The spur track is arranged at the front of the yard and depressed so that the loading dock is on a level with the car floors.

The construction is frame of the usual mill type. The plant is designed for the manufacture of face and fire brick and sewer pipe. The machinery for the brick is in one end of the building and the sewer pipe machinery is located in the other end with the power house between. In front of these are the drying buildings used for the drying of sewer pipe and fire brick. The face brick are dry pressed and dried in the kilns. This part of the building is three hundred by eighty-five feet and three and one-half storeys high.

Machinery

The grinding of the clays for all three departments is done by the same method. The crushed clay in the storage bins is let out through the bottom into 9-ft. dry pans where it is crushed fine enough to pass through slots 3/32-in. wide and one inch long. It drops through these slots into a hopper bottom which leads to an elevator boot. These pans are of heavy construction weighing about 36,000 pounds each. They are round horizontal pans 9-ft. in diameter with a 12-in. rim or flange around them. The pans are held on and turned by a 6-in. vertical shaft running up through the centre and supported on the bottom by a bronze step, on top of which is a horizontal bevelled crown gear keyed to the vertical shaft. This is rotated by a vertical bevel pinion on a horizontal shaft. The pan revolves at 30 r.p.m. The crushing is done by means of two mullers or crusher rollers which are 48-in. in diameter and 12-in. wide. They are very heavy, being made of cast iron with chilled tires to keep them from wearing. These mullers rest on the pan bottom about twelve inches each side of the center shaft and are held in position by means of a shaft running through them to slotted guides on each side of the pan. There is a yoke in the centre between the two mullers around the centre vertical pan shaft which holds the muller shaft. As the pan revolves the mullers also revolve as they are resting on the pan. They are held in position by their shaft. When the clay is dumped in the revolving pan a scraper guide in front of each muller guides the clay under the muller where it is crushed. The instant it passes from beneath the muller, centrifugal force throws it to the outside of the pan where it is held in by the pan rim or flange. The outside 15-in. to 18-in. of the pan bottom is full of slots, so that the clay in being thrown by centrifugal force from under the mullers to the pan rim passes over these slots and all the clay which is sufficiently fine drops through the slots into the hopper bottom. The clay which is too coarse and goes to the pan rim is again caught by the second scraper and guided under the second muller where it is again crushed, etc.

All the fine clay which has dropped through the pan bottom into the hopper and elevator boot is lifted in the ordinary type belt and bucket elevator up into the screen room about 40 ft. above the pans. The clay passes in the buckets over the head wheel of the elevator and is thrown free of the buckets on to perforated steel plates. These plates are four feet wide and arranged in sets twenty feet long on an incline of 40 degrees from horizontal. The clay runs down the screen and all fine particles fall through the perforations while the coarse particles run down the plates to a tailings chute which returns them back to the dry pans to be reground until fine enough to pass through the screen perforations. The clay which has passed through the screen perforations is caught in a chute underneath and carried into ground clay bunkers. The fineness of the screening depends upon what the clay is intended to be used for. For making fire brick the clay is not screened at all, while for face brick (dry pressed) it is screened through perforations 3/32-in. in diameter. For sewer pipe the size of grain varies with the size of pipe to be made. The finer the better for securing a dense body, but if the clay is too fine it requires a longer time to burn it. The general practice is to use fine clay in the small pipe which have thin walls and a coarser clay in the larger pipe with thicker walls. As stated above all clays go through the same process to this stage and then receive different treatments from now forward, the treatment depending on the class of ware to be manufactured.

Sewer Pipe

The ground clay bunkers for the sewer pipe department are built on the second floor of the factory and arranged with hopper bottoms so that the clay can be taken out by gravity. Directly under the bins are the wet pans arranged in tandem. These pans are very similar to the dry pans described above with the following exceptions. They are eight feet in diameter instead of nine and have solid bottoms, i.e., no screen plates in them, and the mullers are about half as wide as those in the dry pans. These pans are used for tempering the clay, that is, mixing it with water in sufficient amount to form a plastic mass stiff enough to be worked or modelled by hand. The method of mixing the clay and water is to let about two hundred pounds of clay drop into the revolving pan and at the same time open the valve and let in sufficient water. The amount of water is determined by practice only and depends on the skill of the operator. The reason of this is that the character of the clays, size of grain, amount of moisture in the ground clay, etc., all effect the amount of water required and these are all variables. The clay revolving with the pan is caught by the scraper guides and forced under the mullers and so on around the pan. The scrapers are arranged so that they not only guide the clay under the mullers but also turn it over as a plough does. This constant turning and kneading soon thoroughly mixes the clay and water and develops plasticity, the amount depending on the character of the clay and the length of time the charge is left in the pan. The amount of water required makes the clay wet enough to form balls which do not stick and are stiff enough to go to the outside of the pan, being driven by centrifugal force. The charge is taken from the pan by means of a shovel. This shovel is about ten feet long and is held over the top of the pan on a universal jointed fulcrum. The fulcrum is about three feet from the shovel end of the shovel and holds it in such a way that the operator can lift up the handle end and the scoop will dip down into the pan just inside the rim. The pan revolves against the shovel point so that when it is lowered into the pan the clay runs up on to the shovel. When it is filled the operator pulls down on the handle lifting the shovel of clay up out of the pan, and then by pushing the handle in towards the pan and giving it a turn, he can throw the clay over the pan rim into a hopper which carries the tempered clay into an elevator boot.

As mentioned above there are two pans arranged in tandem. They are placed in line and far enough apart so that the rims are about three feet apart at the nearest point. The hopper is between the two and can be used for both. The pans revolve in opposite directions and the operator stands at the edge of the hopper between the pans and both pans revolve toward him. Each pan has a shovel attached. In operating the pans are filled and emptied alternately so that while one pan is being charged the other is being emptied and no time is lost in the operation.

The tempered clay which falls into the elevator boot is caught up on flat buckets and lifted up about forty feet. The buckets being on a belt which is sufficiently off the perpendicular, i.e., leaning back far enough so that the clay will not roll off the flat buckets. The elevator dumps the clay onto the storage feeder belt which is a 24-in. belt about twenty feet long with side boards so that a large quantity of clay can be stored on it. It is arranged with power drive controlled by an operator who can move it at will so as to distribute the clay along the belt as well as to unload the clay from the far end as the clay is required for further operations.

From here the clay goes to the sewer pipe press. The press, which is known as the one rod type, stands three and a half storeys high. It is made up of two direct connected cylinders known as the steam and mud cylinders. The steam cylinder is on top and the mud cylinder beneath, the space between the two being about four feet. They are supported on a heavy steel frame and held high enough so that the bottom of the mud cylinder is even with the ceiling of the second storey. The steam cylinder has a diameter of 44 inches and a 60-in. stroke, while the mud cylinder is 21-in. in diameter. The rod is very heavy and has a plunger on the lower end of the diameter of the mud cylinder. When the piston head is lifted to the high end of the steam cylinder the plunger is about 18 in. above the top of the mud cylinder, thus leaving it wide open. A chute is built from the end of the storage feeder belt leading down into the mud cylinder. The feeder belt is placed high enough so that the chute is sufficiently steep for the clay to roll from it when pushed off the end, down into the mud cylinder. This operation is controlled by the operator who also controls the distribution of clay along the belt, as described above. Just enough clay is let into the cylinder to fill it up. When filled, the pressman, who stands on the second floor, controls the steam valve of the cylinder by means of a lever, turns the steam into the cylinder above the piston head and forces the rod down, thus pushing the plunger and clay down into the mud cylinder. The mud cylinder is so constructed that different dies can be put on the bottom of it. A different die is used or each size of pipe.

Sewer pipe dies consist of three pieces, known as the "bell," the "former" and the "outside" die, which not only determines the shape of the outside of the pipe, but also makes the socket when the former is fitted in. The bell is a bell shape casting whose extreme outside diameter is the size of the inside of pipe. This bell is held up in the press on a stem which is fastened directly under the centre of the mud cylinder by means of a three-legged spider, the spider legs reaching out from the centre and cast into a ring bolted on the nozzle of the mud cylinder. These spider legs are made as thin as possible and have vertical corrugations. These corrugations are hardly noticeable at the top of the legs but are so pronounced at the lower edge that they form a wavey knife edge. This is done so that the clay passing down through the machine under pressure and passing by, these spider legs is roughened up to such an extent that it will reunite directly under the legs to form a solid mass again.

The outside die is bolted on to the ring and tapers from that diameter gradually in to a ring the size of the outside of the pipe proper. This point is directly in horizontal line with the end of the bell. Looking up from beneath, the position of the bell and outside are such that the orifice formed is the exact shape of the main body of the pipe without the socket. When the clay is forced down through this opening it is in the form of a pipe. In order to form the socket on the pipe the outside die continues below the end of the bell but the opening expands out and forms a shoulder the width of the outside of the socket and then remains at this diameter and extends down the length of the outside of the socket. In order to form the inside of the socket there is a rod directly beneath the centre of the bell which slides up and down in guides under the floor. This former rod, as it is called, is counterbalanced and controlled by the pressman by means of a belt driven friction pulley. Sitting on the top of the rod is the third part of the die or the former. This former is the exact shape of the inside of the socket and is made with projecting lugs so that when it is lifted up against the bell these lugs are pushed into hooks on the outside die. This locks the whole die together and leaves a space on the inside which is the exact shape of the socket of the pipe.

Close view of Kilgard plant, showing detail of kilns.

When this is locked the operator again throws his steam on top of the piston head and pushes it and the plunger down, thus forcing the clay in the mud cylinder down into the locked die. There is a row of issue holes in the former which permit the air to be forced out as the clay is forced in and the clay is allowed to continue to be pushed in the die until it also issues out through the issue holes, thus indicating that the socket is formed. The pressure is then released by cutting off the steam pressure, the former unlocked by twisting it in the rod and the pressure again applied. This pressure pushes the former [illegible] into pushing the clay out of the die through the orifice formed by the bell and throat of the outside of the die, thus making the rest of the pipe. This pressure is maintained until the pipe is the desired length, when it is stopped. The former is pushed on down, leaving the socket clear and a socket board is placed in the socket. This board is held by two men called "turners," and the pipe is then cut from the die at the top. It is then placed in front of the press on a bench and cut to length with a piano wire cutter supported from above, on a pipe with a forked bottom, the wire being stretched on the ends of the two prongs. When cut the turners turn the pipe so that the spicket end is down, and put it on a drying board on a truck. All sizes of pipe from 4-in. to 24-in. are made in this manner by using the different sized dies. In nearly every case the turning has to be done differently on account of the differing weights. For example, a 4-in. pipe weighs about 19 pounds, while a 24-in. pipe weighs 500 pounds at the press. The large pipe, 18-in. and up, are turned on floor cradles while the 16-in. to 10-in. are turned on bench cradles and the 8-in. and less turned by hand. It is not unusual to turn out two miles of four-inch or 2,000 feet of 24-inch pipe in a day's run (10 hours).

As the above description shows, the processes from the tempering of the clay on are intermittent and depend a good deal on the skill of the men. The mud cylinder of the pipe press has to be charged regularly and this is done by lifting the plunger clear of the mud cylinder and refilling with clay from the storage feeder belt. Large pipe sometimes require the mud cylinder to be filled twice to make one pipe, with one charge. There are many minor details of the press of great importance, such as the steam die hoist used in lifting the heavy dies into place when changing from one size to another, the cutter, etc.

Crusher plant where all clays are received into the factory. The trestle shown is a tram line from clay mines.

When the press is operating at full speed the exhaust steam is a tremendous item. In most plants this is wasted but in the Kilgard plant the exhaust is received in a large tank and distributed through the building in the dryer coils and is sufficient to heat the entire building when the press is running. Live steam is used at night.

The drying of the pipe is a very important operation, and with the clays used, can be carried on comparatively quickly. When the pipe leaves the press they are put on the dry floors in rows and the heat is put in the coils in the ceiling so as to dry the pipe from the top or socket end down. It is done this way so that the sockets will be hard enough to turn the pipes over while the spigot end is still damp to allow being fettled. As the drying continues, more heat is turned on and kept on until the pipes are bone dry. This requires anywhere from two to seven days, depending on the size of the pipe.

The drying system is a very important and expensive piece of construction and is a thoroughly complete piece of work at Kilgard. The coils are arranged so as to be controlled individually and they are made up of the live and return headers with direct connected 1¼-in. pipe 18-in. centres on the lower floors and 30-in. centres on the upper floors. These headers are 16 ft. long and the coils from 30 to 50 feet. The live steam headers are fed with steam from both sides by main feeders leading from the exhaust tank as described above.

The return of the water is accomplished by the use of a vacuum pump and Dunham Blast Traps which permit the pump to suck out only the water and air. They act almost immediately and are very satisfactory. From the vacuum pump the water goes into a separating tank where the air and water are separated and the water flows into a hot well receiver from which it is pumped back to the boiler. Wherever this system is used a thoroughly good oil separator should be employed. The dry pipe are ready for setting in the kilns and burning.

The plant is equipped with six thirty-six-foot inside diameter down draft sewer pipe kilns and two more will no doubt be added shortly. The burning of any clay wares is of vital importance to the manufacturer and the kilns, as well as the burning, should be studied with extreme care.

At Kilgard the kilns are arranged in batteries of four with one stack between them. The object in this is that the stack will always be warm so that when a cold kiln is lighted it will have the warm stack to help out the draft at the start. The kilns are circular and have fourteen fire boxes around them with horizontal grate bars. The fire boxes extend through the walls of the kilns so that the coal is shovelled in the doors outside and the heat created passes up into the kilns. Directly around the fire boxes inside the kilns is a brick wall with an opening at the top so that all the heat coming from the boxes goes right up to the top of the kilns. These walls are known as bags and not only throw the heat up but also protect the ware directly in front from too severe heat treatment. The walls of the kilns are about ten feet high outside and seven feet inside. At this point the crowns start to turn and form the roofs. They take the form of an arc and the crowns are about 15 feet above the floor at the centre. The floors are made of perforated or checker brick supported with walls running parallel across the kiln and about 15 in. high. These walls form flues. Beneath the brick floor on which these walls rest is another set of flues which radiate out from a centre well hole. There are fourteen of these radial flues, one between each fire box. Opening up from the flues at about three places are openings into the upper part of the kiln. From the well hole there is a main flue about three feet square which leads to the stack. This flue is nearly eight feet under ground. All these flues and openings are proportioned according to equivalent areas and the distances from the main flue, etc. When the fires are lighted the heat will rise up in the kilns from the boxes through the bags and then be sucked down through the perforated floor into the radial flues, then to the well hole, through the main flue and up into the stack. It is easily seen that it requires considerable draft to create this long down draft and hence the advantage of having four kilns to one stack so as to keep it warm. The stack is also divided into four parts so as to keep each kiln independent. This is necessary, as when a kiln gets hot, so much draft is created that it completely uses up all the available part of the stack and acts as a damper to the cooler kilns and retards their burning instead of helping it out, if the divisions are not in the stack.

The ware is brought out of the building by means of gravity elevators which let the truckloads of pipe down from the upper floors. It is then wheeled into the kilns and placed in rings around the kiln starting at the outside and working towards the centre, always leaving a backing out space in front of the door. The pipe are placed one on top of the other four high for pipe two feet long, and three high for pipe two and a half feet long. All bottom pipe are set on rings of the unfired clay made of sections of pipe and are always the same diameter as the pipe placed on them. The reason for this is that the pipe shrink in burning and the bottom pipe with the weight of the other pipe on top is so heavy that if it was setting on the bottom made of fired brick with the shrinkage all out, it would be bound to crack in trying to shrink. By placing on these short rings they do the cracking and leave the pipe in good shape. The rings are about 3 in. high.

Coal is used for the sewer pipe burning, while for the burning of face brick and fire brick, fuel oil is employed. The brick are set in four rectangular down draft kilns, each with a holding capacity of about 160,000 brick. These kilns are arranged with a row of fire boxes down each side and doors at each end. They are arched over from side to side to form the crowns and are 16 feet across inside and 72 feet long. The crown arch starts at about 7 feet from the floors, and is 14 feet high in the middle. The fuel oil is sprayed into the kilns through atomizer burners, using steam as an atomizer. These are known as Schur's burners and are manufactured in Los Angeles, Cal., where oil burning is carried on very extensively. The oil burning system has proved to be not only cheaper per equivalent unit than coal, but the labor and trouble saving is marked, being in the ratio of about as two is to seven. In addition, the quality of heat generated by oil produces a much superior and more even colored product.

Face brick are manufactured on a four-mould dry press at the Kilgard plant with a capacity of 24,000 brick every ten hours. An average daily output of 20,000 brick is, however, considered satisfactory. The output of the plant consists of white, buff and red burning face brick, fire brick, blocks for coke ovens, and special fire clay shapes, and sewer pipe. The machinery installed at Kilgard was purchased as far as possible from Canadian manufacturers, but some of it had to be secured of necessity from the United States. All the dry and wet pans, and the four-mould brick press equipment were supplied by the [illegible] Machinery Company, of Toronto, Ont. The sewer pipe press, storage feeder, elevators, trucks, rockers, cradles, etc., for handling sewer pipe, were supplied by the Stevenson Company of Wellsville, Ohio. The entire plant is driven by individual motors, all of which were supplied by the Canadian Westinghouse Company, of Hamilton, Ont. The plant is equipped with the following motors: seven 50 h.p.; one 35 h.p.; one 25 h.p.; two 12 h.p.; two 10 h.p.; four 5 h.p.

Electric current is furnished by the Western Canada Power Company from their Stave Falls power plant, which is located about 20 miles north of Kilgard. The Kilgard Fire Clay Company's plant, which started operating in September, 1913, was financed by local, Vancouver and English capital, and represents an investment of approximately $300,000. The construction of the entire plant as well as the working out of the different mixtures, systems, and the commencement of actual operations, was under the supervision of Mr. F. H. Riddle, a well-known ceramic engineer, who has had considerable practical experience in the clay industries. Prior to his connection with the Kilgard Company, Mr. Riddle, for a number of years, acted in an advisory capacity with the American Sewer Pipe Company, of Akron, Ohio, where he was engaged principally in the manufacture of brick, sewer pipe and hollow wares. He has been a member of the American Ceramic Society for several years past.

Brick Pavements as an Investment*

RECENTLY I observed the revenue from two separate farms of three hundred and twenty acres each, located in the corn belt of Illinois—one at the end of a four-mile brick paved road and the other at the end of a four-mile mud road. These farms should produce under the ordinary rotation of crops annually two hundred and eighty tons of corn, eighty tons of oats, and one hundred and twenty tons of hay, or four hundred and eighty tons in the aggregate to be delivered over four miles of roadway. On the brick road there has been delivered eleven tons of grain in one trip by one team, using five wagons, while on the earth road two tons were all that could be delivered by a similar team. The haul being four miles in both cases, and as they could make three trips a day, twenty-four miles team travel, the team on the earth road could deliver six tons a day at a cost for team and wagon of $4.50, thus making a cost of 75 cents a ton for the four-mile haul. On the brick road the delivery was 33 tons a day at a cost of 19.7 cents a ton on a four-mile haul—a difference of 55 cents a ton in the cost of delivery in favor of the brick road, or a difference in cost of $264 on the 480 tons delivered. This is only a small per cent. of the actual loss to the farmer living on the earth road, as he has had to sell his grain at a time when the roads were in condition that it could be delivered without regard to the price of his product. From actual experience it has been demonstrated that this would represent a loss of $1.50 a ton on corn, $2.50 a ton on oats, and $5.00 a ton on hay, making a loss in the aggregate of $920 on account of not being able to deliver at the best market price. This with the loss in cost of delivering makes $1,184, or 10 per cent. on an investment of $11,840, an increase in value of $36 an acre on his 320-acre farm. This represents the investment in a nine foot brick highway that has cost the tax payers of the township $10,000 a mile; or if all of the principal highways of the township could be improved, would only represent a tax on all of the property, or $10 an acre. These brick roads are not a liability; they are an asset. They don't cost you money they make you money. It isn't a question of whether you can afford brick roads—the question is, how can you get money enough together to do without them. Bad roads are expensive. The most expensive road is the one you cannot use.

The cost of a brick road ten feet in width at $1,100 per foot in width per mile as compared with the roads being built of other materials at a cost of $550 per foot in width per mile at the end of a twenty-year period has been demonstrated to be less expensive after adding to the original cost in each instance five per cent. on original cost together with the maintenance in either case for the twenty-year period. This does not take into account the expense and inconvenience due to the repairs and re-surfacing of the cheaper roadway, nor does it give credit to the brick road for being in a serviceable condition at all times for the twenty-year period. Many brick streets that have withstood the the traffic and the effect of the elements for more than twenty years are in perfect condition to-day.

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*Extract of paper by W. T. [illegible]

It has been said by a prominent authority that "the life of a well-constructed brick pavement cannot be estimated with any great degree of exactness: first, because the traffic conditions are constantly changing; and second because no brick pavement which has been constructed in accordance with the best modern practice has yet worn out. The amount of wear sustained by given pavements during comparatively long periods of years has been determined in several instances, but periods of years has been determined in several instances, but has usually been so small as to make the probable term of service appear almost indefinite."

From such evidence we may conclude that the properly-constructed brick road is entitled to a life of twenty years without repair, or a period long enough to allow us to forget that the original construction ever cost anything. The original cost is as far as many of us can see. Benefits are too seldom looked into. We are inclined to complain of taxation as a burden instead of a blessing and the real foundation of our civilization. The greatest assets of the most substantial nature are transportation and agriculture. Neither can be fully developed without the other.

The total tonnage drawn over the highway at this time may be quite small, but upon the improvement and development of the road and the resources of the country, the tonnage may be increased many tons. While the requirements of to-day may be only ten to twenty tons, these improved conditions have caused this road to become a main highway, with from two hundred to three hundred vehicles a day, many of them three to six-ton trucks. Not only should the improvement be made to care for the present traffic, but to provide for a far greater traffic, not only in the number of vehicles but in their character. The traffic which was once only local, confined to teams from a few of the neighboring towns and villages, has become inter-state, and almost national in character.

Such roadways should have a firm unyielding foundation. The drains should be brick so that the water will not remain in side ditches or be held in the sub-soil higher than within eighteen inches of the wearing surface. Upon the foundation it has been found necessary to provide a sand-cushion of sufficient depth to compensate for the irregularities in the base and the difference in the depth of the units used in the wearing surface. This cushion may be of a specified depth from one to two inches, preferably not more than one and one-half inches. The most important feature is that this sand-cushion should be made firm and evenly compacted, that the bricks may rest thereon without imbedding them, as the space between the bricks should be left open to receive the bonding material. The specifications should make provision for the character of sand to be used and the proper preparation of the sand bed. The material for the wearing surface should be of such a character as to withstand the action of the elements for all time. The material should be of such character and should be placed in the roadway in such a manner as to offer the least resistance to travel. The surface should be made smooth, and so bonded together as to become monolithic. Proper specifications should provide that the bonding material should surround every unit, and that this bond should be of a permanent and enduring character.

These highways should be so improved that they will require the minimum of maintenance and last in a serviceable condition longer than the life of the bond issue created to provide for their investment.

A portable crane-controlling device which is in use at the docks of the Manchester Ship Canal Company, at Manchester, Eng., enables a cargo-handling crane to be controlled by an operator standing near the work instead of riding on the crane. The controller weighs about 7 lb. and is hung from the operator's shoulders; two handles govern the lifting, lowering and swinging movement. From the controller switch an armored cable leads to the crane ring and to a set of small collector rings, the motors being operated through a system of controllers. By means of this appliance the discharge and loading of ship's cargo can be performed more rapidly and safely than under the ordinary system. The crane operator can stand at the ship hatchway, more about freely and keep in sight and control of the load from the time it leaves the bottom of the hold.

Buoys of reinforced concrete built for Kingston, Jamaica, weigh each about 5 tons, carry about one ton of ballast, and are said to cost a little less than half as much as steel buoys of the same size. The buoys are cylindrical in shape, with the bottom concaved to give protection to the mooring chain eye bolt. The sides have curved horizontal ribs, with bottom reinforced bars built up inside the shell, and waterproof cement on the outside and inside builds up the total thickness of the sides to 3 inches. The top is a solid slab, with reinforcement extended down the side. A temporary manhole serves for removing the interior centering and for convenience in lowering; but its cover is sealed in place when the work is finished. As water sometimes leaks in during the first few days a buoy is in use, a pump hole with brass screw cap is provided.

Mining material for the manufacture of lime from the bottom of the sea is one of the unique sights on the island of Martinique, French West Indies. The bulk of the lime used on the island is manufactured from madreporic stone, or reef coral so mined. It is of good quality when made with care. Procuring the material for making lime would appear to be a most hazardous employment. The reefs from which the coral rock is taken are in the bay, fully a mile from shore. Small dugouts are floated over the reef and the coral brought up from the bottom by hooks or grapnels attached to poles 12 to 14 feet long. The boats are loaded until but a few inches of the sides are above water. It requires both skill and experience to load the boats without upsetting and to land the cargo without sinking.

LETTERS

Concerning Architectural Competitions

Montreal, April 8, 1914.

Editor Contract Record:

Your editorial published under the above heading in your issue of March 18 raises a question which the architectural profession has been discussing for many years. It is a matter which, probably, the profession will never be able to decide satisfactorily for all its members.

In Canada we are not troubled with architectural competitions to the extent that the architects of England and the older countries are. In England it is a well known fact that for practically all work of a public nature competitive designs are invited, and it is no uncommon thing to find that one hundred, or one hundred and fifty, architects will submit designs in competition for a building that is to cost only $75,000. When one considers the enormous amount of labor and money that such a competition represents in the preparation of all these designs one cannot regard with favor such a method of selecting an architect. It is a fact that the better known and more experienced men in these older countries often refuse to enter into competition under such laborious conditions. This is not surprising, for if an architect is busily engaged in private practice he will not want to spend his time in "taking chances," unless the bait be particularly tempting.

In the case of the London County Council Buildings two competitions were held. In the first, hundreds of competitors entered and twelve were selected. In the second, these twelve were invited to submit new designs, together with eight experienced and well known men at the top of the profession. The eight were paid for their designs and had not been asked to compete in the first instance. The result was satisfactory to all and the winner proved to be a young man who was not in practice for himself and whose talent probably would never have been discovered had it not been for such a competition.

In another well-known case, that of Liverpool Cathedral, we find a young architect in his early twenties coming out on top and by his masterpiece, carried out in stone, fully justifying the selection of his design.

Such cases as these prove that competitions have their good points for architects who have to rely upon such methods of bringing out talent and placing them on a par with more famous and more fortunate confreres.

One of the best known and most successful architects in England of the day once stated in the presence of the writer that he had submitted as many designs as he was years old (43) before meeting with any success. This is not a solitary case. Such instances are plentiful in the older countries. We cannot but admire the dogged perseverance of such men.

In competitions it does not always appear that the design that is worked out the most conscientiously in accordance with the instructions laid down is the one placed first in the end. It is not difficult to recall cases where the successful competitor has wholly disregarded the conditions, honestly believing that by so doing he could submit a better scheme than the promoters had in mind. There have been instances of where his very boldness has appealed to the assessors and the strict interpretation of the conditions has been disregarded in his favor—it may be to the discomfiture of the other competitors.

It is very certain that as this country continues to grow and more improved buildings are contemplated competitive designs will be called for in ever-increasing number. For work of a special character, such as a hospital, theatre or hotel, the best results would seem to be obtained by commissioning an architect direct—selecting a man who makes a specialty of such a type of building. And it is not difficult to find men who concentrate their studies upon structures of special types. In monumental work, such as public buildings and public halls, however, it should be possible to obtain the best results in properly-conducted public competitions. For this reason it is of primary importance that Canadian architects as a body should agree upon certain vital principles embodied in any "Conditions of Competition" before submitting their designs. Where these principles are not agreed to by the promoters, architects will serve their interests best by refraining from taking part in the competition. This stand has been taken by the members of the Royal Institute of British Architects, and it is owing to the loyal support which the Society has received from its members that conditions of competition are generally carried out on the lines laid down by the R. I. B. A.—indeed the Institute is even consulted by public bodies and others before the conditions are advertised. Such a stand taken by such a well-known Society has done untold good to the profession and won for it well-deserved respect from the general public.

Briefly, the more important elements that are insisted upon are the following:—

1. An unbiassed professional assessor (or assessors) whose decision in the awards shall be final.
2. The paying of the successful competitor some stipulated fee for his design should the building **not** be erected after the competition.
3. Designs must not bear any name or nom de plume.
4. All drawings must be uniformly rendered and finished.
5. There must be strict adherence to the conditions of cost, etc.
6. Perspective drawings must not be submitted as a rule, such drawings not being always rendered truly.

I have submitted these few observations at your request and shall look forward to seeing further discussion of the subject in your columns.

Philip J. Turner, F.R.I.B.A.

A Winnipeg Architect Disagrees with Competitions

Winnipeg, March 11, 1914.

Editor Contract Record:

The sentiments expressed in your editorial article, "Are Architectural Competitions in the Best Interests of the Profession?" published in your issue of March 18, are entirely in accord with my own. I have always considered competition a lottery and I do not believe that the awards go to the most capable. I should much prefer to make six sketches for a real client than to be one of six to make sketches for a prospective client. In choosing an architect a client should enquire of others who have had dealings with the profession. With their architect they should look at buildings similar to those they wish to erect. They should take the professional man on the merits of his ability, treat him confidentially and go into all the details with him.

In a competition the competing architect is practically bound to keep his design secret. If he make enquiries about the requirements from some one in charge of the competition it is not long before the identity is revealed and then the competitor is judged by his ability not as shown in the sketch but as it is held in public esteem. This, in my opinion, defeats the object of the competition. We occasionally hear of the obscure draughtsman winning a competition. I have never heard from the client after the completion of the work.

E. D. Tuttle.

Personal Mention

Mr. B. W. Folger, President of the Kingston Street Railway, passed away recently in Toronto.

Mr. John A. Wilson, city engineer of Kamloops, B.C., has resigned and has been succeeded by Mr. E. Kingwell.

Messrs. Turner & Carless, architects, have removed from the Board of Trade Building to 49 Beaver Hall Hill, Montreal.

Mr. Charles L. Smith, general manager of the Oregon Short Line Railroad, passed away last week at St. Catharines, Ont.

The Toronto Harbor Commission have removed their offices from the Bell Telephone Building to apartments in the Otis-Fensom Building, 50 Bay Street, Toronto.

Mr. C. A. P. Turner, consulting and contracting engineer of Minneapolis, Minn., has removed his office from the Phoenix Building to the new Walker-Burton Building in that city.

Mr. J. W. Battershill has been appointed engineer of the Municipality of East Kildonan. Up to the date of his appointment he had been in the City Engineer's Office, Winnipeg.

The town of Sudbury, Ont., is advertising in this issue of the Contract Record for a consulting engineer to work on a salary and percentage basis. Mr. W. J. Ross is the town clerk.

Mr. F. D. Friend, resident engineer for the National Transcontinental Railway, died recently from heart failure. The late Mr. Friend came to Canada about ten years ago from Devonshire, Eng.

Mr. Jas. M. Barker, formerly in the engineering service of the Canadian Pacific Railway as draughtsman, has been appointed Instructor in Civil Engineering at the Massachusetts Institute of Technology.

Mr. S. B. Wass, chief engineer of the Quebec Extension Railroad, is undertaking the work of assistant chief engineer of the St. John (Que.) Railway, a proposed line 174 miles long in Quebec and the State of Maine.

Mr. Wallace Broad addressed the Engineering Society of the University of New Brunswick recently on "Engineering in China." Mr. Broad, who is a graduate of N. B. University, was for a long period mining advisor to the Chinese Government and has spent considerable time in the Orient.

Mr. James Warwood, who was one of Toronto's earliest pipe and brick manufacturers, died on April 7 at Huntsville, Ont., in his seventy-seventh year. His first brick field was situated at Yorkville. He subsequently started another plant at Old Garrison Creek, which is now the Western Stock Yards.

Mr. John Barker, who had been in the employ of the City of Toronto for the last forty-seven years as diver and storekeeper for the waterworks, died on April 2 after a short illness. In early life he was engaged in railway construction work in the southern States and Mexico. As a diver he assisted to lay the first pipe across Toronto Bay.

Mr. Francis S. Cleary, whose death took place at Munrovia, Cal., on March 24, was born in Windsor, Ont., twenty-seven years ago. He was a graduate of the Faculty of Applied Science and Engineering, University of Toronto. For the past two years he had been employed as an electrical engineer with the Edison Illuminating Company, Detroit.

Mr. Walter J. Francis, C.E., Consulting Engineer of Montreal, addressed the last evening meeting for the season of the Ottawa Society of Civil Engineers on April 2, his subject being "The Engineer and the Public," in the course of which he advanced many arguments in favor of a united effort on the part of engineers to elevate the profession by a better education of the young men entering it, the maintenance of a proper standard of dignity and perfection in the engineers' work and co-operation with fellow engineers.

Dr. John Galbraith, Dean of the Faculty of Applied Science and Engineering, University of Toronto, was the guest of honor at a banquet given on March 28 by the graduates of the Faculty who are resident in Ottawa. The function, which was held at the Chateau Laurier, was attended by over eighty graduates and was the first of its kind held by the graduates in engineering of the University of Toronto who reside in Ottawa. Representatives from other centres included Major C. H. Mitchell, Consulting Engineer, Toronto; Professors Wright and Loudon, representing the Faculty of Applied Science and Engineering; Mr. J. L. Morris, C.E., and Surveyor, Pembroke, the earliest graduate of the Institution. An interesting outcome of the function was the appointing of a local committee to arrange for a permanent organization, to be known as The Ottawa branch of the Engineering Alumni Association, University of Toronto.

Mr. A. Gravel, Chairman of the Levis Board of Trade, and member of the Harbor Commission of Quebec, has received a communication from the shipbuilding firm of Sir W. Armstrong with reference to the establishment of a branch of that firm across the river in connection with the new graving dock, on which work is to commence immediately. A delegation composed of the Mayor of Levis and members of the council and board of trade have decided to interview Hon L. P. Pelletier on the occasion of his visit to Quebec, and will seek his influence in the effort to obtain a Government subsidy in aid of the projected industry.

Coming Events

The American Road Builders' Association will hold their next annual congress and exposition in the International Amphitheatre, Chicago, December 14 to 17, 1914.

The Seventeenth Annual Meeting of the American Society for Testing Materials is to be held in Atlantic City, N.J., June 30 to July 4, 1914. The Secretary is Mr. Edgar Marburg, of the University of Pennsylvania, Pa.

Good roads enthusiasts should keep their eye on the Canadian and International Good Roads Congress, which is to be held in Montreal next month (May 18-23). The secretary is Mr. G. A. McNamee, New Birks Building, Montreal.

The Seventh Annual Assembly of The Royal Architectural Institute of Canada is to be held at Quebec City, September 21st and 22nd next. The President of the Institute is Mr. J. H. G. Russell, of Winnipeg, and the Honorary Secretary, Mr. Alcide Chausse.

The Second International Congress of Consulting Engineers will be held at Bern (Switzerland) on the occasion of the Swiss National Exhibition from July 15 to July 22, 1914. The first congress of this kind was held in 1913 at Ghent, Belgium, on the occasion of the Universal Exhibition in that city. At last year's congress an International Federation of Consulting Engineers was founded with a view to unifying the various professional societies already in existence in a number of countries and to assisting in the formation of similar organizations where none has been established. It is desired to establish a strong bond between consulting engineers throughout the entire world, it being considered that such a bond will make for professional advancement. Those who are interested should address enquiries to M. Herbais de Thun, Secretary of the Consulting Engineers'

Congress, 18 rue Marie-Therese, Brussels, Belgium. In sending us these particulars Mr. de Thun advises us that it is proposed to hold the third International Congress at San Francisco in September, 1915.

Protecting the Canadian Stone Industry

The decision of the Government to increase the duty on dressed stone, announced by Mr. White during his budget speech, is the result of representations made by stone cutters and quarry owners throughout Canada. The Montreal Builders' Exchange have taken a foremost part in asking the Government to give increased protection to this industry, and have been represented on two deputations which have waited on the Government within the last two years. The stone cutting and quarry trade section of the Montreal Builders' Exchange in the fall of 1912 presented a very strong petition to the Minister of Finance, setting forth the need for higher duties. They then asked for a specific duty of 65 cents a cubic foot on building stone of any kind, sawn, dressed, hewn, polished, or otherwise manufactured. The Government, however, propose that the duty of 20 per cent. on dressed stone should remain on stone sawn on two sides, but if sawn on four sides it will pay 15 cents per 100 lbs.; and if turned, cut or further manufactured 45 cents per 100 pounds.

The Canadian stonecutters and quarry owners contend that there is plenty of suitable stone in the Dominion for all purposes, if the industry were given proper protection, although architects who specify Indiana limestone and Ohio sandstone state they do so for the reason it is most suitable for their purposes. The present duty is levied on the quarry value of the stone, which in effect makes the duty lower than 20 per cent., and the Canadian trade also complain of discrimination in the matter of railway rates by the American companies. If American stone be imported into Canada, it should be in the rough, so that the labour required to manufacture it would be Canadian. It is urged that higher duties will help to build up a big industry which will be able to give sure and prompt delivery, but until there is a certainty that no dumping will be allowed further capital will not be invested so as to give this positive delivery. The higher duties will be of value to the stone cutters, but apparently do little to protect the quarry owners, as the duty on rough stone remains at 15 per cent.

The business of the MacKay, Paulin Construction Company, Limited, is now being carried on by the Canadian Engineering and Contracting Company, Limited. The personnel of the company remains the same with Mr. James J. MacKay, president, Mr. F. W. Paulin, vice-president and manager, and Mr. F. A. Magee, secretary-treasurer. The new company will carry out all the contracts and engagements of the old firm.

Bulletin B3 of the Herbert Morris Crane & Hoist Company, Limited, Toronto, comprises an illustrated description of the various types of the Morris travelling spur-gear chain-block. This chain-block effects remarkable economy in the saving of time and labor. The various forms in which it is made and its [illegible] with which the Morris firm specialize in lifting machinery. A high speed of lifting is obtained by using a small gear ratio which is only rendered possible by the extreme accuracy of the work which is put into the cutting of the gears and the setting out of the steel side plates. The Herbert Morris firm also manufacture worm-gear, triple-gear, chain-blocks, jib-cranes, overhead cranes and overhead runways.

Dredging in Courtenay Bay is now proceeding, and quite a basin has been dug out. It is stated that two more dredges are on the way to St. John to assist in the work.

Canadian City Engineers

Mr. George Smith, Town Engineer, Midland, Ont.

The Town Engineer of Midland, Ont., Mr. George Smith, is the senior member of the firm of Messrs. Smith & Smith, civil engineers and land surveyors, of Lindsay, Ont. He began his professional career in 1881 as an Ontario Land Surveyor and at the outset was engaged in what is known among the surveying profession as detective work, that is, in retracing obliterated government survey lines, some of which were from eighty to one hundred years old. In the winter of 1905 and 1906, when the Toronto-Sudbury line of the C. N. R. was being built through a country of burnt desolation and the work of establishing the greater number of the lot and concession lines required to be done on their plans baffled the company's best surveyors, every lot and concession line, from the Severn River to Parry Sound and on to the Key Inlet, a distance of over seventy-five miles, was located by Mr. Smith.

In addition to such survey work, Mr. Smith has had extended experience as a valuator in railway arbitration cases.

Town Engineer Smith, Midland, Ont.

His greatest field of activity, however, has been municipal, his work for various councils having extended over thirty-five years, twenty-five of which have been partly taken up with drainage work, under the Drainage Acts, and road construction, including bridge work in the County of Victoria, where he has introduced the concrete beam span slab top bridge, a form of structure which is built in spans of from twenty to forty feet. Last season he engineered the construction of a bridge of his own design across a lake narrows of some three hundred feet, in which five of such 20-foot spans, on top of a riprap fill fourteen feet deep were constructed with satisfactory results. He has built a number of steel and concrete bridges in spans ranging from thirty to eighty feet, and in one case where over four hundred feet had to be spanned he used two eighty feet spans on concrete [illegible] sloped and faced dry wall fill on riprap foundation, the whole work costing nearly $10,000.

The town engineership of Midland was accepted by him early in 1913, the council contemplating the installation of a sewage disposal plant and the carrying out of extensive street improvements.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The McLean Construction Company, Limited, has been incorporated at Toronto with a capital of $500,000.

Port Arthur's building permits for March, 1914, amount in value to $266,488. The largest permit for March was $220,000 for a new customs building.

Messrs. Gauthier & Daoust, of Montreal, are the architects for a new apartment house to be built at Outremont at a cost of $200,000. Tenders are now being received.

Mr. H. C. Mott, St. John, N.B., is preparing plans for a new hospital building to be erected in that city at a cost of $300,000. The city council has been authorized to issue bonds to raise the necessary money for the work.

Port Colborne, Ont., ratepayers will shortly be asked to vote on a bylaw as to giving a fixed assessment and certain other privileges to the Niagara Grain & Feed Company, Limited, who contemplate the erection of the plant at a cost of $200,000.

Mr. Geo. Heidman, building inspector, stated recently that the building season at Stratford, Ont., would probably be one of the best on record. The principal buildings to be constructed include the new Knox Church, new factories and the new Avon school.

The city of Quebec has been authorized to raise the sum of $625,000 for municipal improvements upon which tenders will be called shortly. The details, as given, are as follows: ornamental posts, $125,000; improvements in Limoilou Ward, $100,000; improvements in Belvedere Ward, $250,000; exhibition improvements, $100,000.

The value of building permits issued in St. John in March was $73,500. Several companies are preparing plans for groups of houses to be erected in the outskirts of the city this year, and there will be general activity throughout the summer in building operations.

Not only the company which has the contract for the timber substructure of the new wharves at West St. John, but the company which will construct the concrete face and surface, are assembling their plant and during the spring and summer will have large crews at work night and day.

The City of Toronto has obtained the right from the Ontario legislature to run three roads through Prospect cemetery. One is a continuation of Ascot Avenue, another a continuation of Summit Avenue, while the third is a new thoroughfare to be opened up between Tinmouth and Morrison Avenues.

The Imperial Bank is about to erect a seven-storey branch office at the south-east corner of Yonge and Queen streets, Toronto. It will be of steel construction, fireproofed, and will cost about $200,000. The base will be of granite and the upper storeys of terra cotta. The structure will have a 31-ft. frontage on Yonge street and a depth of 110 ft. along Queen street.

Sir Robert Perks, head of the well-known contracting and engineering firm bearing his name, who is at present in Canada in connection with business matters, declares that it would be waste of public money to deepen the St. Lawrence as an alternative to the proposed Georgian Bay canal. He estimated that the Welland-St. Lawrence project would cost $280,000,000, or double the cost of the Georgian Bay scheme.

The newly constituted Civic Housing Committee of Toronto has recommended to the City Council a comprehensive competition for plans for the proposed model houses with a view to proving in a practical way that artisans' dwellings can be built at a reasonable price within easy reach of the street railways. The designs submitted must comply with the building bylaw and prizes will be given for the best plans sent in.

Hon. Robert Rogers, Minister of Public Works, assured a large deputation from Charlotte County recently that the development of the St. Croix harbor would receive the first consideration of the government when the estimates were brought down, probably next fall. Mr. Rogers emphasized the desire of the government to develop national harbors to encourage as far as was within their power the shipment of Canadian products through Canadian ports.

Work will commence in a few weeks on the erection of a new General Hospital for Walkerville, Ont. The building will be 128 feet by 44 feet and is estimated to cost $75,000. The foundation will be of concrete, with rubble stone facings for the first floor, and red brick above. All the windows will be rusticated stone, while the entrances will be of carved stone, classic design. The whole building will be of fireproof construction. Messrs. Smith & Walker, of Walkerville, are the architects.

The programme of the Highways Commission was laid on the table of the Ontario Legislature a few days ago. The report outlines a plan by which the entire road system of Old Ontario will be completely reorganized and brought under a new treatment designed to make the province a standard for efficient traffic roads on the continent. The outstanding proposal is an expenditure of $30,000,000 on Ontario market and trunk roads in the next fifteen years. The money is to be contributed by province, counties and cities, and also by a tax on motors.

A company to be known as the Dominion Engineering and Machinery Company is to be formed with a Dominion charter to take over the old and well-known Toronto concern, the Ontario Wind Engineer and Pump Company, Limited, which has been in business in Toronto since 1894. The new company will be capitalized at $2,000,000 in equal amounts of cumulative, preference and common stock. The company manufacture agricultural engines and machinery, pumps, windmills, gasoline engines, etc. The new capital will allow extensions of business and will incidentally repay bank advances.

Estimates have been prepared for road improvements to be undertaken this season in Northern Ontario. Details are as follows: Rainy River, $85,000; Kenora, $35,000; Port Arthur, $60,000; Fort William, $90,000; Sudbury, $50,000; Sudbury Soo Trunk Line, $90,000; Sudbury North Bay Trunk Road, $50,000; North Bay Mattawa Trunk Line, $50,000; Haileybury and South Lorraine, $15,000; Elk Lake District, $20,000; South Porcupine, $20,000; Charlton Colonization

Road, $35,000; Road along T. & N. O., $120,000; Road along N. T. R., $105,000; Mattawa to Pembroke, $15,000; Larder Lake Mining Road, $5,000.

Mr. M. J. Butler, consulting engineer of Messrs. Armstrong-Whitworth Company of Canada, has returned from a business trip to England. Mr. Butler announced the other day that the plant at Longueuil will commence operations by September 1. For the first few months the steel will be brought from England in the unfinished state, but in about a year from now the entire process of manufacture from the smelting of the ore upwards will probably be carried out in Canada. He announces that in all probability a Canadian Company will be formed for the marufacture of ergite, the new explosive, the merits of which he enquired into while in England. This explosive is said to be particularly satisfactory as regards transportation, because it comes in two parts, both inert and harmless until mixed.

WESTERN CANADA

At Prince Rupert a court house is to be erected at a cost of $150,000. The architect is Mr. A. A. Cox, Carter-Cotton Building, Vancouver.

A new Presbyterian church has just been opened at Moose Jaw, Sask. The structure, which has a seating capacity of 1,400, entailed an outlay of $190,000.

At Edmonton, Alta., operations are about to commence on the new R. C. Cathedral for which Mr. R. W. Lines, of Edmonton, is the architect. The expenditure involved is $300,000.

During the past year five government wharves have been constructed on the Fraser and Pitt rivers, involving an outlay of between $12,000 and $15,000. The last of the five has just been completed.

Mr. George Aylesworth, of Edmonton, and Mr. Ernest L. Shipman, of New York, will build and equip a moving picture plant, costing $150,000, in Edmonton this year. Work is to begin in June.

At Calgary, Alta., tenders are being received by the architect, Mr. A. Pirie, on an Industrial Housing building, seven storeys high, of reinforced concrete construction, estimated to cost $200,000.

The Board of Governors of Saskatchewan University are receiving tenders for students' residences at Saskatoon estimated to cost $250,000. Messrs. Brown & Vallance, of Montreal, are the architects. Bids close April 20.

Mr. George P. Robson announces that a syndicate of Edmonton capitalists which recently paid $100,000 for a double corner site at Ninth Street and Jasper Avenue, will erect a large business building there this summer.

Good progress is being made with the work of erecting additions to the legislative buildings at Victoria, B.C., and it is expected that the entire new block will be ready for occupation by the various departments next September.

[illegible] thousand dollars is the estimated cost of a three-storey business and office building, 50 by 100 feet, to be erected this season for Dr. F. N. Condell at Ninth street and Jasper avenue, Edmonton. Mr. J. H. Gariepy will also expend [illegible] in a three-storey building.

Western Apartments, Limited, [illegible] a three-storey structure of brick and steel, known as the Allan block. There are [illegible] on the ground floor and forty-two offices and apartments on the upper storeys. Mr. R. Armstrong is manager of the building.

At a meeting of the board of governors of the University of Saskatchewan recently, plans for a new students residence to be added this year to the group of buildings already on the campus, were considered and tenders will be received by the board up to April 20. Messrs. Brown & Vallance, of Montreal, are the architects.

Operations have been renewed on the Normal School which is being erected at Camrose, Alta., at a cost of $250,000. The work is under the supervision of the Provincial Architect, Mr. R. P. Blakey, of Edmonton. The general contractors are Messrs. Read, MacDonald & Brewster.

Edmonton Metal Works, Limited, a branch of the Winnipeg Ceiling Company, which is in turn a branch of the Duluth Corrugated Company, is erecting a factory building, 75 by 125 feet, costing $25,000, near the exhibition grounds in Edmonton. Mr. W. J. Magrath is manager of the plant, which will be equipped with modern machinery.

Mr. Harry V. Shaw, proprietor of the Edmonton cigar factory, will erect this year a four-storey warehouse and factory building, 50 by 130 feet, at a cost of approximately $65,000, for which plans have been drawn by Messrs. Magoon & MacDonald, architects. The entire top floor will be laid with white tile, and the walls treated with waterproof cement. Sawtooth skylight will give a northern light.

Ninety-eight thousand dollars is the estimated cost of a four-storey office and store building, to be erected for Williamson Brothers at Jasper and Fraser avenues, Edmonton. Messrs. Nesbitt & Miller are the contractors, the architect being Mr. E. W. Morehouse. The building will be of fireproof construction throughout, a feature being the front of ivory terra cotta. It is to be completed October 1.

Official announcement is made that the Swift Canadian Company will erect an addition of three storeys, 64 by 80 feet, at its plant at North Edmonton. The structures will be of brick and reinforced steel. The first floor will be used as a carpenter shop, machine shop, blacksmith shop and tin shop. The second and third floors will provide additional storage capacity for the products of the packing plant.

Arrangements have been completed by the city of Edmonton to erect cattle and sheep buildings, an addition to the Manufacturers' building and a new heating plant, costing $87,840, at the exhibition grounds this season. The municipality also has plans for a filtering plant, to cost $117,000. The Consolidated Jewell Filtration Company of New York will do the work.

Messrs. Magoon & MacDonald are preparing plans for a building for the Young Men's Christian Association of Edmonton. When completed the building will have cost $500,000. The structure will be eight storeys in height. There will be a gymnasium 50 by 100 feet, a swimming pool, 22 by 73 feet, and more than 200 rooms, in addition to offices, billiard, reading and class rooms.

Large numbers of contractors from Eastern Canada, the United States and Great Britain have tendered for the construction of the proposed bridge across the Second Narrows, the work to cover foundations, superstructure and completion of the bridge. Separate tenders are invited for the substructure and the main structure. A number of British Columbia contracting firms have also tendered for the work.

Mr. Roland W. Lines, architect, is preparing plans for a cathedral, to cost $250,000, for the English-speaking Catholics of Edmonton. The site selected is near the University of Alberta. The structure will be of Moorish design. In addition the church will erect a palace for Bishop Legal, a large cement building, a power house and residence for the laborers. All the buildings will be of concrete, steel and tile.

In the City of Regina, Sask., during March 80 permits were issued for buildings at an approximate value of $90,000. For the corresponding month of 1913 permits were issued to the value of $440,845. The total value of permits up to March [illegible] of 1913. [illegible] the building

Inspector, Mr. [illegible] Falls, indicate that so far this year building activity in that portion of the west is somewhat below the average.

Two hundred and twenty-one building permits, involving an aggregate expenditure of $583,350, were issued during March in Edmonton. Mr. N. A. McIvor, building inspector, says in a report that this season promises to be characterized by the erection of more substantial structures than in the past, adding: "Better construction in blocks, as well as in residences, is looked forward to, and buildings will have more convenience and will be more in conformity with recognized housing codes."

City Commissioner Yorath proposes that Saskatoon should take the initiative in urging the Provincial Government to adopt a town planning act. In the opinion of Commissioner Yorath, a town planning act should provide for: (a) the design of a proper system of main sewers, water mains and tramways; (b) the types of main, secondary and residential roads; (c) the provision of open spaces, parks and recreation grounds; (d) the space about buildings, their limitations, height and character; (e) the restriction of stores, factories and works to special areas; (f) amenity; (g) compensation and betterment. It is likely that the Council will act in the matter.

The new one-million-dollar station and office building at Vancouver will be ready for occupation in June. The building is of steel frame construction, six storeys high, with a frontage of imposing architectural design with rows of massive Corinthian pillars standing out from a brick background with stone cornice. A four-track passenger platform, 1,000 feet long, is being provided. The C. P. R. has other large schemes in the capital of the province amongst which are important terminal plans, including viaducts and a dock 150 feet wide, to accommodate C. P. R. steamers on the coast service. The dock scheme embraces a water frontage of nearly a mile.

Building in Vancouver so far this year appears to be on the down grade judging from the report of Mr. S. N. Janett, Building Inspector, for March, 1914. From this we learn that for the month under notice the total number of permits issued was 178, and the value of the buildings $568,845 against 244 permits and $1,091,115 in value of buildings for the corresponding month last year. Taking the three months we find the comparison even more marked. The permits issued for the first three months of the present year total 417 against 584 at the corresponding date last year. The value of buildings for the same period this year is $1,042,428 as compared with $4,076,663 in the three months of 1913.

The International Joint Commission at its meeting in Washington, on Tuesday, April 7, resumed consideration of the application of the Michigan Northern Power Company and the Algoma Steel Corporation for authority to divert water to build compensating works in the St. Marys River at Sault Ste. Marie. It will be remembered that the commission had these questions under consideration at its meeting in Detroit last March and had representations made on behalf of the cities of Duluth, Fort William and Port Arthur and other interests on the western end of Lake Superior. It was decided to postpone the final hearing of the application until the regular Washington meeting. Meanwhile a committee representing the Canadian and the United States governments, and of the two applicant companies, have been engaged in drafting for the consideration of the commission at Washington a set of conditions designed to combine such regulation of the dam in the St. Marys River as will effectually safeguard the interests of the municipalities and others at the western end of Lake Superior.

While in the opinion of many civil engineers and others who have explored the country lying between North Vancouver and Squamish the construction of a scenic highway from Capilano to the head of Howe Sound is quite practicable, the majority of those acquainted with the region incline to the view that a more favorable route could be found via Seymour Creek. From a construction point of view the most difficult section lies between the south valley and Britannia. It is suggested that a road could be built around the "big bluff" on the north side of the valley close to where it runs off into Howe Sound at a height of 700 feet from sea level. Mr. H. M. Burwell, of Messrs. Hermon & Burwell, formerly consulting engineer for the city of Vancouver waterworks system, expressed the opinion that a fine scenic highway could be built through to Squamish without much difficulty by following Seymour Creek. The fact that at one time the Pacific Eastern Railway was considering the location of a line from Squamish via Seymour is pointed out as a good argument in favor of the alternative route for a road from North Vancouver.

Canadian Railroad Development

On April 1 the Canadian Northern Railway took over from the contractors 78½ miles of new trackage from Avonlea to Gravelbourg, Sask. It is expected that the line will eventually be extended to Swift Current.

Construction work will be started this season on the Canadian Northern Western line from Oliver to St. Paul de Metis, 100 miles, northeast of Edmonton, for which the bonds are guaranteed by the Provincial Government to the extent of $13,000 a mile. The route is through a thickly-settled agricultural district.

As illustrative of the growth of railway enterprise in the Dominion it will be interesting to mention that there are 7,000 miles of railway sidings in Canada. The Canadian Pacific Railway owns over 300 miles of sidings at Winnipeg, while at Montreal it has probably 300 more. In 1907 there were only 22,453 miles of railway in the Dominion. Today there are 30,000 miles.

The Toronto Terminal Company has approved plans for the Toronto Union Station and Viaduct, and has decided to ask the Secretary of State for permission to increase its borrowing powers from $10,000,000 to $12,000,000, the estimated cost of the work. The Terminal Company have also arranged for a meeting of the Dominion Railway Board in Toronto, when the Board and the City will give final assent to the plans.

The city of Maisonneuve, Que., is opposing the action of the Canadian Pacific Railway in attempting to lay their tracks on the street levels for which they had obtained permission by the Railway Commission. At a council meeting recently Mr. Michaud recalled that when Maisonneuve appealed from the decision of the Railway Commission its action had been endorsed by several large municipalities in the Dominion, including Quebec, Ottawa, Toronto, London, Winnipeg, Edmonton and Vancouver, all of which opposed level crossings.

The culvert on the new Lake Shore line of the Canadian Pacific Railway, about ten miles from Toronto, collapsed a few days ago, owing to undermining by the spring floods. A work train which was running over the culvert at the time was hurled with the tender to the bottom of a 10-foot ravine, the engineer and fireman being killed. At the time the train, which was the first to pass over the newly-constructed road this year, was running slowly, and when the engine reached the centre of the viaduct the structure collapsed. The construction of the Lake Shore line was completed last autumn.

The ability to overcome obstacles in engineering construction is nowhere better illustrated than on the section of the Grand Trunk Pacific along the banks of the Skeena river. The latter is to be one of the sights on the Grand Trunk Pacific route to Prince Rupert. The bed of the river is strewn with gigantic rocks, boulders and sand bars, and these are shifting continually under the force of the river current. By heavy expenditure of money on river appliances the railroad builders made the Skeena river serve as a means of transportation of supplies for a constructional army totalling nearly 3,000 men. Little tunnelling has been done. Nearly 4,000,000 cu. yds. of rock have been excavated on 186 miles of line between Prince Rupert and Hazelton to effect a route through the cascades.

The last mile of steel linking up the entire system of the Grand Trunk Pacific Railway was laid at Nechako River Crossing, B.C., on April 7, in the presence of Mr. Morley Donaldson, vice-president and general manager of the company. The final span of rail was spiked to the ties at 12.45 o'clock, when the road was then declared finished. At a point 371 miles east of Prince Rupert and 1,375 miles west of Winnipeg, in the heart of the rough British Columbia country, the connecting link forming another great transcontinental railway was made. In constructing the road it was necessary to erect 65 steel bridges, which were all built from Government specifications and which if joined together would stretch for five and a half miles. Three of the largest bridges are over 1,000 feet in length.

Montreal Road Congress

The first annual Canadian and International Good Roads Congress, to be held in the Arena, Montreal, from May 18 to 23, promises to be a success. In every part of the Dominion millions of dollars are being expended on the construction of new highways, and the promoters of the Congress believe that a co-operative educational campaign will conduce to economical construction, cheaper maintenance, and more satisfactory results generally. There is great need of a more uniform system of road-building and of wider knowledge on this phase of municipal work.

The Congress has been endorsed by the Canadian Highways Association, Canadian Automoblie Federation, and Canadian Manufacturers' Association, and also has the support of the Ontario and Quebec Provincial Governments. Sir Francois Langlier, Lieutenant-Governor of Quebec, will open the Congress, and will be supported by Mr. W. A. McLean, Highways Commissioner for Ontario and president of the American Road-builders' Association.

On the opening day there will be a reception of guests, the second and third days will be devoted to reading of papers, with a banquet on the evening of the second day; the fourth day will be given over to the Canadian Automobile Federation, and the fifth day will be taken up with visits to various highways in the neighborhood. In the evenings there will be lectures illustrated by moving pictures showing the construction of roads and the use of machinery. The papers will deal with practically every branch of road work, particular attention being given to construction, maintenance, various types of roads, materials, and machinery. The speakers will include Mr. A. H. Blanchard, Professor of Highway Engineering, Columbia University; Mr. W. W. Crosby, consulting engineer Baltimore State Commission; Mr. A. T. Lang, professor of applied science and engineering, Toronto University; Mr. W. H. Campbell, chief of the department of public works, Philadelphia; Mr. Paul de Sargent, chief engineer, State Highway Commission, Augusta; and Lieut.-Col. W. N. Thornton, president of the Ontario Associated Board of Trade, Belleville.

Invitations are being sent to [illegible] different people, and it is hoped that many highway officials from all parts of Canada will be present.

In the exhibition section, a large number of Canadian, American and English firms will be represented, the exhibits comprising road materials and road machinery of every description.

Publications Received

Steel Bridge Designing, by Mr. B. Wells, Professor of Structural Engineering, Armour Institute of Technology. The Myron C. Clark Publishing Company, Chicago. Price $2.50 net.

Among the readers of this journal this book will commend itself to those engaged in the drafting rooms of colleges and bridge offices. Chapters are devoted to the following subjects:—Engineers' Work and Contracts; Bridge Manufacture; Rivets; The Design of a Roof Truss; Types and Details of Highway Bridges; Design of a Rivetted Truss Highway Bridge; Types and Details of Railway Bridges; Design of a Plate Girder Railroad Bridge; Design of a Rivetted Truss Railroad Bridge; A Pin-Connected Bridge; Shop Drawings; Strength of Materials.

A large number of shop and general drawings arranged in such form as to facilitate ready reference enhance the value of this volume.

Inspection of Concrete Construction, by Jerome Cochran, published by The Myron C. Clark Publishing Company, 608 South Dearborn Street, Chicago. Price $4.00 net.

This book is based upon a series of articles contributed by Mr. Cochran to Engineering and Contracting. Briefly it covers all the principal points upon which information may be desired by an inspector of concrete construction. Some idea of the scope of the contents may be gathered from an enumeration of the chapter headings:—Chapter I, Inspection of Hydraulic Cement; Chapter II., Inspection of Sand, Stone, etc.; Chapter III., Inspection of Proportioning and Mixing; Chapter IV., Inspection of Forms, Molds, Centering, etc.; Chapter V., Inspection of Steel Reinforcement; Chapter VI., Inspection of Concreting; Chapter VII., Inspection of Surface Finishes; Chapter VIII., Inspection of Waterproofing; Chapter IX., Inspection of Sidewalks, Curbs and Pavements; Chapter X., Inspection of Ornamental Work, Blocks, etc.; Chapter XI., Inspection of Molding and Driving Concrete Piles; Definition of Terms, List of Authorities, Index.

An interesting, well-illustrated pamphlet describes the Austin Improved Cube Special Street Mixer, manufactured by the Municipal Engineering and Constructing Company, for whom Messrs. Lecky & Collis, Limited, 43 Scott Street, Toronto (also 49 Beaver Hall Hill, Montreal, and Napanee Ont.), are the Canadian agents. Austin Special Concrete Mixers for laying concrete pavement or sub-base for pavement are made in two sizes, the one-third yard holding a one bag mix and the one-half yard holding a two-bag mix. The entire outfit, including engine and boiler, is mounted on heavy steel trucks, with or without distributing boom (20 feet long) The boom will swing at a radius of 80 degrees each way, so that the concrete can be distributed on the street as desired, up to 40 feet width. The machine is equipped with a self-propelling device, arranged to run either backward or forward, and is under perfect control of the operator, who handles the machine with a steering wheel. The bucket, or skip, drops close to the ground, so that the material, which has previously been distributed along the street, can be loaded directly into the charging hopper from wheelbarrows. The system requires two men to operate—one to handle the charging hopper and the other the discharging. The machine is set up from the ground so that carts can be backed directly under the discharge spout, when it is not desirable to use the boom It will travel from one piece of work to another at the rate of one and one-half miles per [illegible]

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherst, N.S.

The laying of sewers, at an estimated cost of $20,000 is proposed by the town council.

Brantford, Ont.

Tenders will be received by the Sec.-treas., F. W. Frank, until 8 p.m., April 30th, for the following: (B) fireproof pump house; (G) pumping machinery; (A) two four million gallon turbine pumps and two motors to operate same for domestic service. (B) two four million gallon booster pumps for fire service, motor driven; (C) Steam turbine alternative for operating booster pumps. Bulk tenders accepted for "B" and "G." Plans and specifications at the City Hall, Brantford, or at the office of the Engineers, Chipman & Power, 204 Mail Building, Toronto.

Calgary, Alta.

A by-law is to be submitted to the ratepayers on May 7th, authorizing the expenditure of $100,000 for the supply of material and the complete construction of a main sewer in Ogden subdivision. At the same time the ratepayers will be asked to authorize the expenditure of $50,000 on improvements to parks, and $60,000 on extensions to the waterworks system.

Estevan, Sask.

Tenders will be received by the Sec.-Treas., P. J. Stephens, until 8 p.m. May 9th, for (a) laying approximately 10,500 ft. of watermains and 16,000 ft. sewer pipe; (d) furnishing cast iron water pipes and specials; (e) furnishing fire hydrants and gate valves; (f) furnishing sewer pipe and junctions. Plans are at the Town Engineer's office, Estevan, and at the office of the Can. Engineer, Winnipeg.

South Edmonton, Alta.

Tbe Commrs. have adopted the City Engineers report and will build a pumping station at a cost of $50,000.

Harwich Twp., Ont.

If the drainage plans about to be submitted to the Twp. Council are adopted a $60,000 bridge for the Pere Marquette Rly. will be built, and 1,500 acres of marshland drained for which a pumping station, etc., will be required.

London, Ont.

Tenders for sewer construction advertised Contract Record April 8, page 81, close May 7 and not May 17 as stated. Wm. N. Ashplant, City Engineer.

Tenders will be received by the City Clerk until April 20th, for power drill, street sweeper, 3 automatic dump waggons, street cleaning machine, and supplies, including picks, shovels, barrows, etc.

Montreal, Que.

F. J. Jago & Co., 10 Victoria St., who have the general contract for the filtration plant invite sub-tenders on roofing, ornamental iron and plumbing.

New Glasgow, N.S.

The construction of sewerage system, at a cost of $25,000 is contemplated by the town council.

The expenditure of $6,000 on road machinery is being considered by the town council.

Quebec, Que.

The city has appropriated the sum of $625,000, which is to be expended as follows:—$125,000 for ornamental posts; $100,000 for improvements in Limoilou Ward; $250,000 for improvements in Belvedere Ward; and $100,000 for Exhibition improvements. Tenders on this work will be called very shortly.

Tenders will be received by Hon. J. A. Tessier, Prov. Govt. Dept. of Highways, until April 24th, for the construction of the Sherbrooke-Derby route highway. Plans and specifications are at the Department.

Regina, Sask.

Tenders are about to be called for the following waterworks supplies: (B) cast iron pipe and specials; (C) lead pipe, galvanized iron pipe, jute rope, black pipe, pig lead; (D) iron body gate valves (Kelfie brand) valve boxes, fire hydrants, brass gate valves; (E) Corporation and curb cocks lead to leal unions, curb boxes. Engineer, J. M. McKay, Supt. of Waterworks.

Stratford, Ont.

The Engineer, A. B. Manson, will receive tenders until 5 p.m., April 25th, for the construction of 1650 ft. 5½-ft. concrete storm sewer arch and 2,940 ft. 2-ft. vitrified glazed pipe sanitary sewer on Erie street.

Plans have been drawn for improvements to the sewage disposal plant. Plans and specifications are at the office of the engineer-in-charge, A. B. Manson, City Hall, they include grit chamber, sedimentation tank, auxiliary gas engine (probably) and chlorination devise.

Sandwich, Ont.

Tenders will be received by the Clerk, E. R. North, until April 20th, for the construction of sewers, watermains and reinforced concrete pavement on Sunset avenue.

St. Catharines, Ont.

It is understood that a liquid chlorinating plant will be installed at once by the city council. Engineer, W. P. Near.

Toronto, Ont.

Plans have been prepared for a combined system of sanitary and storm overflow sewerage system for North Toronto. The disposal plant to be located in Don Valley, will consist of detritus tanks, Imhoff tanks, chlorinating device, sludge-drying beds and sprinkling filters. Estimated cost $4,144,256.

The following work has been recommended by the Commissioner of Works, R. C. Harris: Grading on Morton Road, Particia Drive, Iona, Oakcrest, Patterson, Claude and Merrick streets, Glendale avenue and Keystone Drive. Estimated cost $28,750. The laying of asphalt pavements on Agnes street, $13,782, and bitulithic pavements on Turner, Conrad, Frank, Ashworth, Melita and Willow streets, $37,833, and concrete sidewalks on 17 streets at an estimated cost of $17,135.

Toronto, Ont., Port Credit

The water system by-law will be discussed at the next meeting of the village council. The estimated cost is between $60,000 and $100,000.

Trenton, N.S.

The installation of a water supply system, at a cost of $50,000, is proposed by the town council.

Victoria, B.C.

Tenders will be received by City Purchasing Agent, W. Galt, until 4 p.m. May 4th, for 10,000 ft. 4-in. steel pipe for waterworks purposes.

Winnipeg, Man., St. Vital

Tenders addressed to the Reeve. Grand Vital P.O., will be received until 2 p.m. Aprill 22, for the supply and construction of 1,883 ft. of 24 in.; 2,951 ft. of 20 in.; 8,373 ft. of 18 in.; 8,733 ft. of 15 in.; and 8,990 ft. of 12 in. vitrified sewers. Plans and specifications at the office of the Municipal Engineer, Municipal Hall St. Marys Rd., St. Vital.

Wallaceburg, Ont.

Tenders for the waterworks system close with the Clerk, H. E. Johnson, May 5th. Contract "A1," laying water mains; contract "A2," laying sewers; contract "C," water tower and foundations; contract "D," water pipes and specials; contract "E," fire hydrants, gate valves, valve boxes; contract "F," mechanical pressure filters; contract "I," intake and basin; contract "M," laying force main; contract "S," furnishing sewer pipe. Plans and specifications are at the office of the Engineers, Chipman & Power, Mail Bldg., Toronto, and at the Resident Engineer's office, Wallaceburg.

Yarmouth, N.S.

The laying of clay pipe sewers, at an estimated cost of $50,000, is being considered by the town council.

CONTRACTS AWARDED

Elmira, Ont.

A contract has been awarded by the town council to A. M. Bauman for digging, backfilling, tapping mains, furnishing pipe and all fittings in connection with the construction of the waterworks.

Montreal, Que.
The following contracts have been awarded by the Board of Commrs. F. D. Lawrence, 4195 Sherbrooke St., 1,700,000 paving artificial Scoria blocks, $48 per M. 1,700,000 paving artificial Scoria blocks (smaller) $43.50 per M. 10,000 special Scoria blocks $12.50 per M. 10,000 blocks at $40 per M. The Elder Ebano Co., Que. Bank Bldg., 60,000 Shawmut blocks, $46.75 per M.

Ottawa, Ont.
The following contracts for the supply of vitrified clay pipe have been awarded by the City Council: Wright & Co., 252 Catherine St., for ordinary vitrified clay pipe; T. S. Kirby & Co., Sussex St., for Gart Craig brand of pipe.

Toronto, Ont.
The following sewer contracts have been awarded by the Board of Control. Grant Contracting Co., 50 Front St. E., Durie St., $9,000; W. E. Taylor, 438 Clinton St.: Gilmour Ave., $1,272; Kent Rd., $1,238; Kingswood Ave., $4,093; Benson Ave., $1,247. Turner & Alexander, 24 Adelaide St. E.: Gerrard St., $5,677; Silver Birch Ave., $3,998. J. L. Boyd, 84 Victoria St.: Lincoln Ave., $685. J. H. McKnight Construction Co., 88 St. David St.: Morton Rd., $874; West Lake Ave., $864. W. R. Hunter, 90 Charles St.: Stevenson Ave., $3,688. Commissioner of Works, R. C. Harris: Sorauren Ave., $3,590; Gilbert Ave., $4,356; Norman Ave., $2,110. Midway Drainage Outlet from Cannon Ave., $19,100, and to the Gawne Contracting Co., 43 Victoria St., for a storm overflow sewer on Argyle from Shaw St. to Gladstone Ave.
The Board of Control has awarded to the United Brick Co., Greenburg, Pa., the contract for the supply of Conneant Dunn wire cut lug blocks at $29.40 per thousand.

The following contracts for pavement construction have been awarded by the Board of Control. Commr. of Works, R. C. Harris, day labor, asphalt on Agnes St. $10,856, Blevins St. $1,102, Cornwall St. $2,136, Bloor St. $24,720, Boultbee St. $2,647; Contracting & Paving Co., Confed. Life Bldg., asphaltic concrete on High Park Ave. $21,168.80.

Windsor, Ont.
The following contracts have been awarded by the City Council (Water Commsn.). The Gartshore-Thompson Pipe & Foundry Co., Stuart St. W., Hamilton, cast iron pipe, at $31.50 a ton; Kerr Engine Works, Walkerville, 4 valves; Rae, Stephens Co., Detroit, Mich., 10 hydrants; J. Kovinsky, Windsor, 10 tons pig iron; Bingham, Taylor Co., Buffalo, N.Y., 100 valve boxes.

Railroads, Bridges and Wharves

Edmonton, Alta.
The construction at a cost of $175,000 of a retaining wall along River Saskatchewan and Jasper Ave., is being considered by the Public Works Dept.

Twp. of Etobicoke, Ont.
Tenders will be received by the Clerk, S. Barratt, Islington, Ont., until noon, May 1st, for the construction of a concrete bridge over the Mimico Creek between Concessions 3 and 4, Lot 24. Plans and specifications at office of the Engineer, Frank Barber, 57 Adelaide St. E., Toronto.

Plans have been prepared for a wooden overhead bridge over the G. T. R. tracks at Innis Ave. Estimated cost, $2,800.

Simcoe, Ont.
The Lake Erie & Northern Rly. Co. have been authorized to construct bridge across Lynn Pond and Lynn River.

Smith, Alta.
The Edmonton, Dunvegan & B. C. Railroad contemplate erecting a 9-stall roundhouse here.

St. Hyacinthe, Que.
The city council has decided to build a new bridge across Perrault Brook.

St. Johns, Que.
The C. P. Rly. has been authorized to construct bridge No. 19.86 on Farnham Sub.-Div., Eastern Div., across Richelieu street.

St. John, N.B.
Messrs. Powers & Brewer, St. John, have been awarded by the C. P. R. the contract for the substructure of Weymouth Bridge over the Sissibou River on the Dominion Atlantic Railway. This is one of the largest and most important bridge structures on the D. A. R., the substructure consisting of twelve massive concrete piers, including one draw pier, and two abutments. The contractors are arranging to start the work at once and the whole work will be completed this season.

Toronto, Ont.
Plans have been approved by the Works Commr. for the construction of a 3-arch concrete bridge on Crawford St., at an estimated cost of $30,000. Tenders will be called shortly.

Toronto, Ont., Cedar Grove
Plans are to be prepared for the construction of a bridge over Rouge River at Cedar Grove. Engineers, Bowman & Connor, 36 Toronto St., Toronto.

Trenton, Ont.
The C. L. O. & W. Rly. has been authorized to construct bridge No. 88.0 across Trent River.

Winnipeg, Man.
Plans for the construction of a railroad from Winnipeg to Edmonton via Yorkton, Saskatoon and Battleford, have been filed by the Central Canada Ry. Co. J. D. McArthur Co., Ltd., McArthur Bldg., are the general contractors.

CONTRACTS AWARDED

East Williams Twp., Ont.
The Twp. Council has awarded to David Witherspoon, Nairn, Ont., the contract for the erection of the Wyatt, Gordon and McKay bridges.

Wellington, Ont.
The contract has been awarded by the Public Works Department to [illegible] Pratt-Handy, Ltd., 43 Scott St., Toronto.

Ottawa, Ont.
The contract for alterations to the Sussex St. bridge has been awarded to the Dom. Bridge Co., Sparks street.

Quyon, Que.
The contract for wharf construction has been awarded by the Public Works Department to J. & T. Moran, Arnprior, Ont.

Regina, Sask.
The following contracts have been awarded in connection with the erection of the G. T. P. railway station. General contractors, Lyall Mitchell & Co., 16th and Albert St. Masonry, Alex Young, 1548 Retallack street.

Victoria, B.C.
The contract for the construction of a wharf at Songhees Reserve, has been let by the Marine & Fisheries Dept., to J. H. Parks, C. Tupper & G. H. Kirkpatrick, 633 Hastings St., W. Vancouver.

Public Buildings, Churches, Schools, etc.

Assiniboia, Sask.
Tenders for the erection of a school for the School Board, will be received by the Architect, Geo. J. G. Jarrett, or the Sec., J. B. Smith, up to April 27th.

Barrie, Ont.
Tenders will be received by the Chairman County Property Com., P. McLeod, Box 661, Orillia, until April 30th, for the whole or part of the material required for the erection of the judges' chambers. Plans are at the office of A. W. Beardsley, Court House, Barrie.

Berlin, Ont.
Mr. Jacob Kaufman has offered to erect a 5-storey Y. W. C. A. building, if the site selected is changed. The Bldg. Com. recommends the acceptance of Mr. Kaufman's offer.

Brantford, Ont.
New tenders on the Rawdon St. School will be received by the Sec., A. K. Bunnell, until 1 p.m. April 22nd. Plans are at the office of the Architects, Taylor & Bodley, Hope Chambers.

Calgary, Alta.
Tenders for the steel work in connection with the alterations to the incinerator are invited by the Commissioners.

Durban, Man.
Tenders will be called shortly for the erection of a school for the Durban School Dist., at a cost of $5,000.

Fredericton, N.B.
Tenders will be received by Sec. Board of Education, Chas. Simpson, until April 18th, for the erection of a 2-storey school building on Smythe St. Estimated cost $37,500. Architect, G. E. Fairweather, 84 Germain St., St. John, N.B.

Humboldt, Sask.
Tenders on the erection of a court house, to cost $70,000, are about to be called by the Public Works Dept.

Ingersoll, Ont.
Tenders for additions and alterations to the post office will be received by R. C. Desrochers, Secretary, Public Works Department, Ottawa, until April 20th. Plans are at Station "F," Toronto, and the post office, Ingersoll.

Kamloops, B.C.
Tenders for the erection of a drill hall will be received by R. C. Desrochers, Secretary, Public Works Department, Ottawa, until 4 p.m., May 7th. Plans,

specifications, etc., at the offices of Mr. Wm. Henderson, resident architect, Victoria; Caretaker, Public Bldg., Kamloops, and at Department, Ottawa; also at the office of MacLean Daily Reports, 220 King St. W., Toronto, Ont.

Kentville, N.S.

Plans for the erection of a new Presbyterian church are being prepared by W. M. Brown, architect, Cragg Bldg., Halifax; the estimated cost is $15,000.

London, Ont.

Plans are in progress for the erection of a school building on Grand Ave., at a cost of $40,000.

Plans for the erection of a new church for the Ridout St. Methodist Congregation, at a cost of $25,000, have been drawn by Vicar Munro, architect, 54 Bank of Toronto Chambers.

Meaford, Ont.

The erection of a post office at a cost of from $35,000 to $40,000, is proposed by the Public Works Dept.

Montreal, Que.

Plans for the Liverpool, London & Globe Assurance Co. office building have been drawn by Nobbs & Hydye, Old Birks Bldg., and J. R. Gardiner, Beaver Hall Hill, who expect to call tenders in about two weeks. Estimated cost $175,000.

Tenders on a presbytery for St. Michaels Parish, are invited by Beaugrand, Champagne & Chenevert, architects, St. Catherine E., until April 27th.

Certain additions to the Royal Victoria Hospital, Pine Ave., are contemplated, and an architect will be appointed shortly to draw the necessary plans.

Anglins, Ltd., 65 Victoria St., who have the general contract for alterations to Esplanade Ave. School, is inviting tenders now for roofing, mill work and tile and marble work.

Montreal, Que., Cote des Neiges

Plans for a $2,500,000 church for L'Oratoire St. Joseph, Cote des Neiges, are being drawn by Viau & Venne, architects, 76 St. Gabriel St., Montreal.

New Glasgow, N.S.

The town council propose to erect a 3-storey school building, at a cost of $15,000.

Palmerston, Ont.

The tenders on post office, customs house and armory having been considered unsatisfactory, new tenders will be called shortly.

Paquetville, Que.

R. A. Frechet, architect, 30 Bonnacord St., Moncton, has plans in hand for the erection of a Roman Catholic church, estimated to cost $50,000.

Port Elgin, Ont.

Tenders for the erection of a school and residence will be received by J. D. McLean, Sec. Dept. of Indian Affairs, Ottawa. Plans, etc., are at the office of A. J. Duncan, Indian Agent, Cape Croker, Ont., Post Offices, Wiarton, Wiarton, Owen Sound and Port Elgin, and at the Dept., Ottawa.

Regina, Sask.

Tenders for extension to the college will be received by the Architect, J. H. Puntin, 308 Darke Block, until April 18. The complete erection of Eastern and Western towers and a ladies' residence are included in the project; the estimated cost of which is $100,000.

A site for the erection of a labor temple, has been purchased on Lorne and 13th Ave., by the Regina Labor Temple Co., St. John and 10th Ave.

A by-law will be submitted to the ratepayers April 23rd to raise $36,000 for the purchase of a site or the new Collegiate and enlarging and equipping of present building.

Rankin, Ont.

Plans for St. Thomas Church have been drawn by C. P. Meredith, architect, 126 Sparks St., Ottawa.

Saskatoon, Sask.

Tenders for the erection of a students residence in connection with the University of Saskatchewan will close with the Principal, W. C. Murray. Architects, Brown & Vallance, 32 Can. Life Bldg., Montreal. Estimated cost $150,000.

Swift Current, Sask.

Plans for the erection of a court house, at a cost of $125,000, have been drawn by the Public Works Dept. Tenders to be called in May.

Toronto, Ont.

A site has been selected on Dundas St. near St. Johns Rd. for the West End Branch of the Technical School. Estimated cost of the site, building and equipment is $500,000.

Toronto, Ont. (Fairbank)

The Township Council has passed a by-law to purchase a site at a cost of $6,000 for the erection of a public school for school section No. 15 York.

Toronto, Ont. (Oakridges)

Tenders for the erection of a school building will be received by S. B. Coon & Son, architects, Ryrie Bldg., Toronto, until April 28th.

Toronto, Ont., Port Credit

The village council are considering the erection of a new building combining the fire hall and the library.

North Vancouver, B.C.

A site for a central school has been selected by the School Board and building plans will be prepared at once. Es-

Vanguard, Sask.

Tenders for the erection of a school for the Vanguard School Dist. No. 2136, will be received by the Sec.-Treas., Thos. Ward, Vanguard, until April 25th. Plans and specifications are with the Sec.-Treas. or at the office of Beaver Lumber Co., Vanguard.

Windsor, Ont.

Tenders for the erection of a public school, on Wyandotte St., will be received by Alex. Black, Sec. Board of Education, until April 27th Architect, J. C. Pennington, La Belle Bldg. The estimated cost is $60,000. Plans and specifications for a heating and ventilating system are being prepared by Messrs. Taylor & Waltz, Ford Bldg., Detroit, Mich.

Winnipeg, Man.

The erection of St. Johns Presbyterian Church, on Cathedral Ave., will not be proceeded with this year owing to finances not being arranged.

CONTRACTS AWARDED

Aurora, Ont.

The contract for the erection of the post office and customs house has been awarded by the Public Works Dept. to Thomas Bass, Midland, Ont., $24,000.

Banff, Alta.

The bathhouse contract has been awarded by the Dept. for the Interior to Worswick Bros., 129 Hart Ave., Elmwood, Winnipeg.

Dartmouth, N.S.

The post office contract has been awarded by the Public Works Department to Thomson & Theakston, Hollis St., Halifax.

Elmira, Ont.

The following contracts have been awarded in connection with the erection of St. James Lutheran Church. Cement foundation, Jno. E. Bowman; masonry, Chas. Wilken; carpentry and roofing, Jacob Foerster; painting, Dan. Keller; heating, James Smart, Brockville.

Ottawa, Ont.

The following contracts have been awarded in connection with additions to Hopewell Ave. School. Masonry, C. Holbrook & Son, 425 Somerset St.; carpentry, A. Christie, 359 Elgin St.; galvanized iron, Architectural Metal Co., Vaughan St.; roofing, J. Carnochan, 5th Ave.; plastering, A. Bowman & Sons, 239 Florence St.; painting, A. E. Rea & Co., Ltd., Rideau St.; heating, Currie-Livock, Ltd., Bank St.; plumbing, J. R. McLennan, Bank St.; electrical, Marchand & Donnelly, 128½ Sparks St.; closet enclosures, Campbell Steel & Iron Works, Carling Ave.

The following contracts have been awarded in connection with the erection of Kent St. Manual School. Masonry, Alex. Garvock, Lewis St.; carpentry, painting and electrical by day labor; galvanized iron, T. A. Woods & Co., Mutchmore Street; roofing, J. Carnochan, 5th Ave.; plumbing, J. R. McLennan, Bank street.

Stratford, Ont.

The following sub contracts have been awarded in connection with the erection of the new school in Avon Ward. Mosonry, Cement Products Ltd., St. Clair Ave. W., Toronto; steel, Toronto Structural Steel Co., Ltd., Atlantic Ave., Toronto.

The following sub contracts have been awarded in connection with the erection of Church St. School. Masonry, Geo. Paul, 156 Victoria St., Sarnia; steel, Toronto Structural Steel Co., Ltd., Atlantic Ave., Toronto.

Victoria, B.C.

The contract for the erection of the new St. Columba Presbyterian Church has been let to Knott & Jones, 1327 Pandora St.

Winchester, Ont.

The contract for the erection of the high school has been secured by Helmer & Winstanley, Morrisburg, Ont.

Winnipeg, Man.

The contract for the erection of the Selkirk Ave. School, has been secured by the Sutherland Constr. Co., Carlton Building.

Business Buildings and Industrial Plants

Aylmer, Que.

Tenders for the erection of stables for 100 box stalls are being received by the president of the Connaught Park Racing Association, F. W. Carling, Metropolitan Life Bldg., Ottawa.

Charlottetown, P.E.I.

Plans are being drawn for the construction of a fox ranch near here for Fur Producers, Ltd., care Fur Farmers Bureau & Exchange, Ltd., Charlottetown. Wire fencing, burglar alarms, electric lighting plant and waterworks system will be required.

Chilliwack, B.C.

Plans for a branch bank for the Merchants Bank of Canada have been prepared.

Douglastown, N.B.

Plans are being prepared for the erection of a Society Hall by H. B. McDonald, architect. Estimated cost $10,000.

Edmonton, Alta.

Plans are in progress for the erection of 3 stores and pool room on Main St., for Mr. McYelvey.

The theatre on Second street, excavation for which was started two years ago, may be built this year.

Winnipeg Box Factory of Winnipeg contemplate the erection of a box factory, to employ 100 people.

The erection of stores and apartments on Jasper Ave., at a cost of $50,000, is proposed by J. H. Gariepy, 493 4th St.

Dr. N. Condell, 537 5th St., has under consideration the erection of a store and apartment block on Jasper Ave.

Harriston, Ont.

It is understood that McColl Bros., Don Esplanade, Toronto, will build a plant to replace buildings recently destroyed by fire. A site has not yet been selected.

Iroquois Falls, Ont.

Plans for the erection of paper mills to cost $100,000, have been drawn for the Abitibi Pulp & Paper Co., 156 St. James St., Montreal, by Geo. F. Hardy, architect and engineer, 309 Broadway, New York City.

Medicine Hat, Alta.

Plans for the erection of a confectionery factory at a cost of [illegible] have been drawn for the Tabor Candy Co., tenders for which will be called shortly. Architects, [illegible] & Morrison, Hooper & Huckvale Block.

Moncton, N.B.

Plans for a coal shed to cost $6,000 are being prepared for J. E. Masters Co., Ltd., 86 Botsford St., by W. C. Barnes, architect; the building is to be equipped with overhead track and coal bunks, size 40 x 60 ft., concrete foundation, corrugated iron and frame construction, spruce floors, asphalt patent roofing.

Montreal, Que.

A. F. Byers, 340 University St., who has the general contract for additions to the plant of the Thos. Davidson Mfg. Co., is calling tenders for plumbing and drains.

Anglins Ltd., 65 Victoria St., the general contractors for the erection of the Sault office building, 307 St. James St., are receiving prices on mill work, roofing, galvanized iron, plumbing, electric, elevators and ornamental iron, brick and reinforced concrete construction.

Montreal, Que. (Maisonneuve)

Plans for the branch bank for the Bank of Montreal have been drawn by Barott, Blackader & Webster, architects, New Birks Bldg., who expect to call tenders shortly.

La Parisienne Shoe Co., La Salle Ave., will call tenders shortly for brick work and concrete foundation connected with the proposed addition to their premises.

Mt. Brydges, Ont.

Plans for bank premises for the Union Bank of Canada have been drawn by McBride & Gilbert, architects, Edge Block, London.

Ottawa, Ont.

Plans for an $18,000 club house for the Ottawa Canoe Club have been drawn by C. P. Meredith, architect, 126 Sparks Street.

Port Colborne, Ont.

The Niagara Grain & Feed Co., Ltd., has secured a site near Government Elevator for the erection of a $200,000 plant. The ratepayers will vote on granting a fixed assessment of $10,000 for ten years.

Regina, Sask.

The erection of a business block on 10th and St. John Sts., at a cost of $25,000, is proposed by J. Schwartzfeld, 1337 10th Ave.

Sutton, Que.

A site has been purchased for the erection of an I. O. O. F. hall and clubrooms which will be erected this summer.

Toronto, Ont.

Plans for additions to the Wolseley Motor Car Company's garage, 81 Avenue Road, have been drawn by E. J. Lennox, architect, 164 Bay Street.

Plans for the construction of a plant for the Crystal Ice Makers, Ltd., are being drawn by L. Foulds, architect, 21 Leader Lane.

F. J. Gallanough, 304 Brunswick Ave., will receive tenders for laying brick and all other trades in connection with the erection of store and apartments on Bloor Street West.

Tenders will be received by the Board of Control until April 28th, for ice machine, equipment complete, including piping, cork insulation, floors of freezing rooms, cold storage, doors and windows, electric wiring, plastering, painting, tracking, conveyors, motors, scales, rocks for freezing, etc., for the civic abattoir on Keating street.

Vancouver, B.C.

A permit for the erection of a club house, to cost $8,000, on 16th avenue and Fir street, has been issued to the Vancouver Tennis Club. Architects, MacLure & Fox, 744 Hastings St. W. General contractor, T. L. Gray, 1745 First Avenue East.

Victoria, B.C.

Plans are being prepared for the erection of three stores and apartment house to cost $35,000, on Fort St., by Fox & Berrill, architects, Brown Block, Broad Street.

A permit for the erection of a stable at a cost of $16,000 has been issued to T. G. McBride, 1051 Main Street.

Winnipeg, Man. (St. Boniface)

Alterations and additions to the Belgian Club, Provencher Ave., are proposed. Architect, J. A. Hudon, 602 Great West Permanent Loan Bldg. Estimated cost $20,000.

Woodstock, N.B.

Plans for an exhibition building for the Agricultural Society are being drawn by W. C. Barnes, architect, Moncton.

CONTRACTS AWARDED

Montreal, Que.

Messrs. A. F. Byers & Co., Ltd., have been awarded the contract for the erection of a new galvanizing building at Delisle St., for the Thomas Davidson Manufacturing Co., Ltd. Plans are by Messrs. T. Pringle & Son, Ltd. The contract includes excavation, concrete, brick, roofing, drains, etc. The contract price is $8,622.50.

The following sub-contracts have been awarded in connection with alterations to the stores of Keuffel & Esser, 252 Notre Dame W.: roofing, Richardson Simard & Co., 745 Clarke St.; electrical, W. J. O'Leary & Co., 36 Recollet St. Heating and plumbing to be let shortly.

Montreal, Que. (St. Henry)

The contract for the erection of the Simonds Canada Saw Co. factory, 92 St. Remi St., has been secured by C. E. Deakin, Ltd., 41 Mayor St.

Montreal, Que. (Westmount)

The following contracts have been awarded in connection with alterations and additions to the stores and residences on Sherbrooke St. for D. R. McCord, Cote des Neiges Rd., Montreal: Masonry, Murray & Ritchie, Coristine Bldg.; carpentry, Wm. Every, rear 449 Bleury St.; roofing, Standard Roofing Co., 189 McCord St.; plastering, J. Lefebvre, 150 Ontario St. E.; heating and plumbing, M. Paton, care architect; electrical, Crown Electric Co., 591 St. Catharine St. W.; tile, Dom. Floor & Wall Tile Co., 409 Aylmer Street.

Ottawa, Ont.

The contract for the masonry work connected with the erection of stores and apartments on Rideau Street for Donald Fraser, 58 O'Connor St., has been let to R. J. Watson, 186 Hawthorn St. Other trades are not let yet.

Prince Rupert, B.C.

The contract for the erection of a hotel on Second Ave. for [illegible] has been secured by Mitchell & [illegible].

Strathroy, Ont.

The contract for the Canadian Handle Co. factory has been secured by John J. Smith, Strathroy.

Toronto, Ont.

The contract for additions to the Canada Metal Co. factory, Fraser Ave., has been let to [illegible] Road.

Residences

Hamilton, Ont.
New tenders on the erection of an apartment house, James St. S., are wanted by W. G. Brown, architect, [illegible] Block, until April 24th.

London, Ont.
Bennett & Thwaites, Barton and Stirton streets, Hamilton, have abandoned the idea of erecting an apartment house on King St. E.

Moncton, N.B.
Plans for a $9,000 residence for R. N. Wyse, are being drawn by W. C. Barnes, architect.

Montreal, Que.
A permit for alterations to the residence at a cost of $9,000, has been issued to Dr. J. A. Handfield, 440 St. Denis St.

Mr. Ed. Maxwell, 6 Beaver Hall Sq., has decided to erect a new residence instead of making alterations.

Geo. A. Fuller Co., Ltd., 45 St. Alexander, who has the contract for the erection of an abutment house on Sherbrooke St., for E. Maxwell, is taking prices now on stone, carpentry, ornamental iron and plastering.

Permits have been issued to Geo. Lalancette, 201 Valois St., for flats on Valois and Stadacona Sts., to cost $5,500; and to Odilon Belanger, 136 Fabre St., for flats on Pie IV. St., to cost $11,000.

A permit for the erection of six flats on Fortune St., to cost $5,000, has been issued to L. Methot, 213 Essex Street.

The erection of an $85,000 residence on West Crescent Heights is being considered by a client of R. E. Bostrom, architect, McGill Bldg., Montreal.

A permit for the erection of flats on Cartier street at a cost of $14,000, has been issued to H. Dubois, 1550 Chabot Street.

Montreal, Que. (Outremont)
Plans for the erection of a residence at a cost of $35,000, have been drawn by A. Charbonneau, 2145 St. Urbain St.

Plans for the erection of a residence at a cost of $24,000 have been drawn for Latour & Guindon, 494 St. Catherine St. E., by E. Guindon, architect.

Plans for the erection of a $200,000 apartment house on Durocher St. are being drawn for A. L. and J. A. Caron, 233 Bleury street, by Gauthier & Daoust, architects, 180 St. James St., who will receive bulk and separate tenders.

Montreal West, Que.
Plans for the erection of a $9,000 residence on Campbell St. for C. W. Mitchinson, Fenwick Ave, and C. Jorgensen, Campbell Ave., Montreal West, are being drawn by F. M. Nelson.

Oakville, Ont.
Plans for a country residence and barns at a cost of $50,000, are being drawn for A. P. Turner by Chapman & McGiffin, architects, Tyrrell Bldg., Toronto, who will be ready for tenders shortly.

Ottawa, Ont.
The erection of an apartment house on St. Andrew St. is contemplated by Orila Duford, 46 Water St.

Peterboro, Ont.
The erection of an apartment house is proposed by Henry Hickey, contractor. Architect, Sandford H. Fleming, 194 Chapel St., Ottawa.

Regina, Sask.
A permit for the erection of a $5,000 residence on Retallack St. has been granted to Mrs. M. O. Wylie. General contractors, Murphy & Martin, 2102 Rose Street.

Toronto, Ont.
Plans for an apartment house on Clinton street have been drawn for Geo. Nicholson, 61 Clinton St.

Walkerville, Ont.
Stahl, Kinsey & Chapman, Strathcona Block, are drawing plans for a $7,000 residence on Argyle Road for Capt. J. B. Forrest.

Weyburn, Sask.
Plans for the erection of a $65,000 apartment block are being drawn for Wm. Little.

Windsor, Ont.
Plans for the erection of a residence on Glengary street for Nathan Cohn are being drawn by G. Jacques & Co., Boug Bldg., who will receive tenders until April 20th.

Winnipeg, Man.
T. J. Porte, 300 Portage Ave., has purchased a site for the erection of a residence.

CONTRACTS AWARDED

Halifax, N.S.
The contract for the erection of a residence on Tower Road for Wm. E. Barry, has been let to Maxner & Dunlap, 152 Windsor Street.

Kingston, Ont.
The following sub-contracts have been awarded in connection with the erection of a residence on King St. W. for D. A. Weese: masonry, J. W. Smith, 101 Pine St.; carpentry, Asseltine & Bustard; heating and plumbing, Taylor & Hamilton, 89 Princess St.; electrical, James Halliday.

Montreal, Que.
The contract for the erection of an indoor tennis court at Cote des Neiges has been awarded to A. F. Byers & Co., Ltd., 56 Beaver Hall Hill. Harold E. Storey is the architect.

Messrs. A. F. Byers & Co., Ltd., have been awarded the contract for alterations and additions to residence Stanley St. for Dr. Little. Messrs. Nobbs & Hyde are the architects. The amount of the contract is about $5,000.

The contract for the erection of the apartment house on Sherbrooke street for Mr. Ed. Maxwell has been awarded to Geo. A. Fuller Co., Ltd., 45 St. Alexander Street.

Toronto, Ont.
The contract for the erection of three detached residences on Oriole Gardens for T. P. Stewart, 212 Poplar Plains Rd., has been awarded to H. H. Tillinghaste, 79 Oriole Road.

The contract for the erection of four detached residences on Indian Grove for G. R. Donovan, 564 Dufferin St., has been awarded to Davis & Moore, 288 St. Clarens Ave.

Winnipeg, Man.
The contract for the erection of a residence on Crescent Road for W. Morley Le Page, 478 Balmoral Street, has been let to Sparrow Bros., 340 Dromore Ave.

Windsor, Ont.
The following contracts have been awarded in connection with the erection of a double residence, on Pelissier St., for Mrs. A. C. Chase. Masonry and roofing, Herbert Wilson;; carpentry, U. F. Dumouchelle, 104 Jeanette Ave. Other trades are not yet let.

Power Plants, Electricity and Telephones

Calgary, Alta.
A bylaw will be submitted to the ratepayers on May 7th for authority to expend the sum of $300,000 on equiping and extending street and house lighting systems.

Canso, N.S.
The expenditure of $15,000 for electric lighting purposes is contemplated by the Town Council.

Edmonton, Alta.
Plans have been drawn for the construction of a power house on the Garneau Sub-division have been drawn for the Roman Catholic denomination by R. W. Lines, architect, Canada Permanent Building.

Montreal, Que.
Surveys for hydro electric development at the Lachine Rapids have been made on behalf of a private syndicate in which W. B. Powell, Can. Express Bldg., Montreal, is interested.

Peterboro, Ont.
The Peterboro Radial Railway Company propose to spend the sum of $40,000 to provide for trackage, sidings, etc. Several additional cars will be purchased.

Arrangements are about completed by the Canadian General Electric Company for securing a right-of-way for one mile of track. When this is secured the company will expend $150,000 on new buildings, etc.

Regina, Sask.
Tenders will be received by City Commissioners up to April 27th for (a) 100 tons 7-in. steel tee rails, 1,000 track bolts and nuts, 3¾ x ¾ in.; 1,320 10⅛ in., 42 in. and 72 in. copper rail bonds; (b) 9,000 bbls. Portland cement; (c) 3 miles 500,000 c.m. T.B.W.P. stranded feeder wire, 2 miles 4/0 T.B.W.P. stranded feeder wire, 2 miles hard drawn round trolley wires; (d) trolley frogs, crossovers, line ears, insulators, hangers and pole line hardware. Plans and specifications at the office of the Superintendent, H. Doughty.

Stratford, Ont.
The expenditure of $21,173 on the electric lighting plant is contemplated by the City Council. It is proposed to replace the present system in the business section of the city with wires underground, iron uprights in place of wooden. 132 500-watt nitrogen filled tungsten lamps of 1,000 c.p., wire and con-

duits will be required. A bylaw will probably be submitted shortly.

Strathroy, Ont.

G. B. Hoskin & Son have been awarded a large number of contracts for wiring houses and will require supplies.

CONTRACTS AWARDED

Regina, Sask.

The power house contract has been awarded by the City Council to Wilson & Wilson, Westmann Chambers. The contract includes brick work, concrete roofing, interior furnishings, etc.

Miscellaneous

Bow Island, Alta.

Tenders will be received by the Sec.-treas., W. A. Bateman, until April 22nd, for excavating and complete construction of a main pipe line from the municipal gas well to the town limits with laterals throughout the town. Plans and specifications at office of secretary.

Calgary, Alta.

All supply houses wishing to tender for civic supplies are requested by J. M. Miller, City Clerk, to send name, address and a list of material handled, to J. B. Chandler, purchasing agent, Stores Department, Calgary.

The City Comrs. are calling tenders for cement, 60,000 bbls., prices f.o.b. City Spurs, Calgary; sand, 15,000 cu. yds., clean bank or clean washed; gravel, 15,000 cu. yds., clean bank or clean washed. The prices are to include delivery on specified streets. Samples and a guarantee bond must be submitted with the tenders.

Cobalt, Ont.

The purchase of mining machinery is contemplated by the Beaver Consolidated Mines, Ltd. The directors propose increasing the capacity of the mine from 100 to 150 tons.

Elmira, Ont.

The construction of an electric-gas line on the G. T. R. to Galt is urgently needed, and the matter is being considered by a Railway Commsn.

Fernhill, Ont.

Gordon Moore, of Ailsa Craig, Ont., is in the market for a large quantity of concrete for the manufacture of concrete tile.

London, Ont.

J. Putherbough, Regent and Wellington Sts., propose to purchase 4 carloads of tapestry bricks.

The license commissioners have ordered the installation of the following fire escapes: Brunswick Hotel (Mr. McIntyre), York and Talbot Sts., 3 stys.; Walper House (L. L. Walper), Carling & Talbot Sts., 3 stys.; Windsor Hotel (Mr. McEvoy), King St., 3 stys.; Bank Hotel (J. H. Battle), King and Talbot Sts.; London Club (J. K. Spry, sec.), Queens Ave., 3 stys.; King Edward Hotel (J. H. Cook), York and Wellington Sts., 3 stys.; City Hotel (A. H. Brener), Dundas St., 3 stys.; Metropolitan Hotel (W. J. Wright), Dundas St., 3 stys.; London House (W. S. Lashbrook), Dundas St., 3 stys.; Travellers Club (F. Harley), Richmond Street, 3 stys.; Grigg House, (Mr. Evans), Richmond St., 2 fire escapes and gongs for 3-sty. hotel; Tecumseh House (G. H. O'Neil), Richmond St., fire gongs, etc., for 4-sty. hotel.

Medicine Hat, Alta.

Tenders will be called shortly by the city council for the supply of 3,000 ft. of 2½ in. fire hose.

Montreal, Que., St. Lambert

The Engineer, Mr. Drinkwater, is now receiving tenders for sand, crushed stone, field stone and cement.

Ottawa, Ont.

Tenders for supplies are called by the Public Works Department, Secretary, R. C. Desrochers, Ottawa. Three separate tenders will be received for Ontario and Quebec, Nova Scotia and New Brunswick and Prince Edward Island, for the following supplies for dredging branch, to close 4 p.m., April 27th. Chain, packing, brooms and brushes, oils and greases, wire rope, hardware, manilla rope, hose, steam pipe, valves and fittings, paint, paint oils, etc. Combined specifications and form of tender at the offices of A. E. Dubuc, Dist. Engineer, Montreal, Que.; J. E. Sing, Dist. Engineer, Confederation Life Bldg., Toronto, and at Department, Ottawa. Form of tender also at the office of MacLean Daily Reports, Limited, 220 King St. W., Toronto.

Petrolea, Ont.

The purchase of oil refining equipment is contemplated by the Canadian Oil Refinery Co.

Palmyra, Ont.

F. Miller, care M. Driver & Sons, is in the market for material required for the manufacture of 50,000 tols.

Peterboro, Ont.

Plans for improvements to the ventilating system are being drawn for the Board of Education by Geo. M. Miller & Co., architects, 93 Yonge St., Toronto.

Sherbrooke, Que.

Tenders will be received by the Secretary, E. C. Gatien, until April 20th, for 6 single dumping wagons.

St. Albert, Alta.

The Acme Brick Co., Jasper Ave., Edmonton, contemplate purchasing $24,000 worth of machinery this spring for their plant at St. Albert.

Winnipeg, Man.

Tenders will be received by the Board of Control up to April [illegible] for the supply of [illegible] self-starting [illegible]. Specifications are with the Engineer, J. G. Glassco, 54 King Street.

CONTRACTS AWARDED

Calgary, Alta.

The following contracts for tools and machinery have been awarded by the city Commrs.: Canadian Fairbanks-Morse Co., 523 8th Ave. W., 1 McDougall, 26 x 24, gap lathe $2,055, 1—36-in. heavy band saw $192.20; Canadian Equipment & Supply Co., 514 11th Ave. W., 1 feed rip saw $324, 1 heavy arm swing saw, $138.48; A. R. Williams Machinery Co., Calgary, 1 No. 6 double emery grinder (Bridgeport) $368, 1 chane saw mortiser, $461, 1—16 in. heavy buzz planer $187; Mussens, Ltd., 10th Ave. and 3rd St. E., 1—16-in. high speed sensitive drill $178, 1 No. 654 haper mandrill (Green River) $22; Calgary Machinery Exchange, 1 steam hammer (Jones Burton & Co.) 7½ cwt. $940; P. D. McLaren, Molsons Bank Bldg., 1 No. 5 Buffalo forge $126.

Montreal, Que.

The following contracts have been awarded by the Board of Commrs. Asso. Auto Delahye, Credit Foncier Bldg., 7 5-ton trucks $6,250 each; 2—3-ton trucks $4,600 each. Motor Import Co., Forum Bldg., 4 Peerless trucks $6,550 each. Auto Francais, Ltd., 29 McGill College Ave., 4—5-ton Berliet $6,250 each.

Ottawa, Ont.

The following contracts have been awarded by the City Council. General Utilities Co., Elgin St., for chemical tanks at $207 each; The Gutta Percha & Rubber Co., 47 Yonge St., Toronto, for fire hose; Ottawa Car Co., Kent & Slater Sts., for tires for fire hose wagon.

Business Notes

Allandale, Ont.

The Railroad House Hotel has been destroyed by fire. Loss $6,000.

Assiniboia, Sask.

A block in the business section was recently destroyed by fire, and the following sustained losses, D. McConachie, loss $5,000; Lloyd & Bingham, garage, loss $4,000.

Capelton, Que.

A fire occurred at the Nichols Chemical Works. The loss amounting to several thousand dollars, was covered by insurance.

Dunrea, Man.

The destruction of a business block by fire inflicted losses upon A. P. McClue, general store, loss $12,000, insurance $6,000; A. Dunlap,Town Hall, loss $1,500, insurance $1,000; International Harvester Co., loss $1,000; L. Cauvreau, pool room and barber shop, loss $3,000; insurance $1,400; A. Lavoie, general store, lass $4,000, insurance $1,800; G. H. Smith, drug store and telephone office, loss $5,000, insurance $2,400. The telephone system was totally destroyed.

Ft. William, Ont .

A serious fire recently occurred at the premises of the Hudson's Bay Co. The loss on building and stock is estimated at $250,000.

Lebret, Sask.

The granary, the shoe shop, the [illegible] and tin shop, and the chopping mili at the Indian Industrial School, have been destroyed by fire, loss [illegible].

Liverpool, N.S.

The following stores were recently destroyed by fire: [illegible], druggist, loss $15,000; Geo. E. Snaddon, tin

(Continued on page [illegible])

Tenders and For Sale Department

CITY OF REGINA

Waterworks Dept.

Sealed tenders will be received by the City Commissioners up till noon, **Wednesday, April 22nd 1914**, for the supply and delivery, freight [illegible] Regina, of the following:—

Contract B.—Cast Iron Pipe and Special Castings.
Contract C.—Lead Pipe, Galvanized Pipe, Jute Rope and 1-in. Black Pipe.
Contract Ca.—Pig Lead.
Contract D.—Iron Body Gate Valves, Valve Boxes and Fire Hydrants.
Contract Da.—2-in. Brass Gate Valves.
Contract E.—Brass Goods, Lead to Lead Unions, Curb Boxes.
Contract F.—Water Meters.
Contract G.—
  G1 Steel Reinforcing
  G2 Portland Cement.
  G3 Steel Pipe or Alternative.

Specifications and other information may be obtained at the office of the undersigned.

A marked cheque for five per cent. of the bid must accompany each tender.

The City does not bind itself to accept the lowest or any tender.

J. M. MACKAY,
Supt. of Waterworks.
14-15

City of Regina

Sewers

Sealed tenders addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, **May 12th, 1914**, for the following materials and work:—

(A) Supply and delivery of approximately:—
  50,000 lin. ft. of 6-in. sewer pipe.
  57,000 lin. ft. of 8-in. sewer pipe.
  7,000 lin. ft. of 9-in. sewer pipe.
  600 lin. ft. of 10-in. sewer pipe.
  6,000 lin. ft. of 12-in. sewer pipe.
  10,250 lin. ft. of 15-in. sewer pipe.
  6,000 lin. ft. of 18-in. sewer pipe.
  3,000 lin. ft. of 20-in. sewer pipe.
  8,000 lin. ft. of 24-in. sewer pipe.
  258 lin. ft. of 36-in. sewer pipe.
  672 lin. ft. of 39-in. sewer pipe.
  336 lin. ft. of 42-in. sewer pipe.
  753 lin. ft. of 45-in. sewer pipe.
  336 lin. ft. of 48-in. sewer pipe.
  840 lin. ft. of 54-in. sewer pipe.
  2,230 lin. ft. of 60-in. sewer pipe.
  1,400 No. 6-in. off 8-in. x 2-ft. tees.
  200 No. 6-in. off 9-in. x 2-ft. tees.

(B) Supply and delivery of approximately:—
  400,000 sewer brick.

(C) Supply and delivery of approximately:—
  346 Manhole covers and frames.

(D) Supply and delivery of approximately:—
  3,325 manhole steps.

(E) Supply and delivery of approximately:—
  6,000 lbs. oakum.

A copy of plans and specifications and all necessary information will be furnished to intending bidders upon the receipt of a marked cheque for Twenty-five Dollars ($25), made payable to the City of Regina.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The City reserves the right to divide each of the works into two or more contracts, and to reject any or all tenders.

R. MARTIN, Mayor.
L. A. THORNTON,
A. W. POOL, City Commissioners.
F. McARTHUR, City Engineer.
15-16

CHURCH TENDERS

Sealed tenders, marked "Tender," will be received by the undersigned until 5 o'clock p.m. on **Tuesday, April 21st, 1914**, for the erection of a new Presbyterian Church in the Village of Alvinston, Ont.

Plans and specifications can be seen at the office of the Architect, Wm. G. Murray, Dominion Savings Building, London, Ont., or at the office of the Secretary in the Village of Alvinston, Ont.

A deposit of $500 must accompany each tender as a guarantee of good faith. The lowest or any tender not necessarily accepted.

P. A. McDIARMID,
Secretary Building Committee.
Alvinston, April 1, 1914.
14-15

Township of Burford

Whiteman's Creek Bridge

Sealed tenders, clearly endorsed on the outside "Tender for Superstructure," will be received by the Township of Burford up to noon on **Saturday, May 2nd, 1914**, for the manufacture and erection of a Class "B" steel highway bridge over Whiteman's Creek on the Side Road one mile north of the village of Burford.

Specifications and instructions to bidders may be had from Jackson & Company, Temple Building, Brantford.

Tenders should be addressed to the Township Clerk, F. W. Taylor, Esq., R. R. No. 3, Burford.

ALAN MAIR JACKSON,
Township Engineer.
14-15

Sealed tenders, addressed to the undersigned, and endorsed "Tender for addition and alterations to the Public Building, Ingersoll, Ont.," will be received at this office until 4 p.m. on **Wednesday, April 29, 1914**, for the construction of the aforesaid additions and alterations.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the Postmaster, Ingersoll, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, April 7, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—59106.
15-16

CITY OF BRANTFORD
PROVINCE OF ONTARIO

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer of the Board of Water Commissioners until 8 p.m., **Thursday, April 30th, 1914**, for the following works:—

Contract "B"
FIRE PROOF PUMP HOUSE
Contract "G"
PUMPING MACHINERY

(a) Two, four million gallon Turbine Pumps and two motors to operate same for domestic service.

(b) Two, four million gallon Booster Pumps for fire service motor driven.

(c) Steam Turbine alternative for operating Booster Pumps.

Bidders may submit bulk offers for "B" and "G."

Plans and specifications may be seen at the City Hall, Brantford, or at the office of the Engineers, 204 Mail Building, Toronto.

Lowest or any tender not necessarily accepted.

JOHN FAIR, Esq., Chairman.
F. W. FRANK, Esq., Sec.-Treasurer.
CHIPMAN & POWER, Engineers.
14-15

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Electric Material, Parliament and Departmental Buildings, Ottawa," will be received at this office until 4 p.m., on **Monday, April 20, 1914**, for the supplying of electric material, including transformers, switchboards, nameboards, conduit, etc., as per plan, list and specification.

Plans, specification and forms of contract can be seen and forms of tender obtained on application to Mr. Thos. Hastings, Postal Station "F," Toronto; Mr. R. L. Deschamps, Superintendent, Montreal General Post Office, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, April 8, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—58995.
15

Corporation of the Town of Pointe Claire

Pointe Claire, P.Q.

Tenders for Roads

Sealed tenders addressed to the Secretary-Treasurer and endorsed "Tender for Road Construction," will be received at the office of the Corporation at Pointe Claire until 12 noon on **Wednesday, May 6th, 1914.**

Plans, specifications, form of tender, and full information will be furnished on application to the undersigned on or after April 15th, 1914.

A deposit of $20 will be required before plans and specifications will be given out, which will be refunded on their return in good condition.

The lowest or any tender not necessarily accepted.

G. C. ANDERSON,
Resident Engineer.
Pointe Claire, Que. 15-16

Sealed tenders addressed to the undersigned and endorsed "Tender for Coal for Departmental Dredges, Ontario and Quebec," will be received at this office until 4 p.m., on **Monday, April 27, 1914,** for the supply of Best Quality, Steam, Anthracite and Blacksmith Coal to be delivered in quantities and at places mentioned on forms of tender.

Combined specification and form of tender can be obtained at this Department and at the offices of A. E. Dubuc, Esq., District Engineer, Shaughnessy Building, Montreal, Que.; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont.

Tenders will not be considered unless made upon forms furnished by the Department and in accordance with conditions contained therein.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for the amount mentioned in the tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
—55671. Ottawa, April 6, 1914 14-15

City of Moose Jaw

Tenders for Sewer Pipe, Cast Iron Pipe, Valves and Hydrants

Sealed tenders, endorsed "Tender for [illegible] Pipe," or "Cast Iron Pipe," or "Valves and Hydrants," addressed to the City Commissioners, Moose Jaw, will be received up to 10 a.m. on **Wednesday, May 6th, 1914,** for the supply and delivery f.o.b. Moose Jaw, of the following:

- Contract No. 82—For the supply of 115,000 feet of sewer tile pipe, [illegible]
- Contract No. 83—For the supply of 1,120 tons of cast iron pipe and 55 tons of special castings.
- Contract No. 84—For the supply of 12 6-in. gate valves, 57 8-in. gate valves; 8 10-in. gate valves, 40 12-in. gate valves and 83 fire hydrants.

Specifications and all further information may be obtained at the City Engineer's office.

Each tender must be accompanied by a marked cheque payable to the City Treasurer, for five (5 p.c.) per cent. of the amount of the tender.

The lowest or any tender not necessarily accepted.

JAMES PASCOE,
GEO. D. MACKIE, City Commissioners
W. F. HEAL,

Dated at Moose Jaw,
This 10th day of April, 1914 15-16

City of Brantford

Steam Road Roller

Sealed tenders addressed to Ald. Geo. Ward, Chairman of the Board of Works, in care of the City Clerk, Brantford, Ont., will be received till 12 o'clock noon on **Monday, April 20th, 1914,** for the furnishing of a 15-ton Steam Road Roller.

Specifications may be obtained from the City Engineer.

The lowest or any tender not necessarily accepted.

T. HARRY JONES,
City Engineer.
City Hall, Brantford,
April 7th, 1914. 15

TOWN OF WALLACEBURG

PROVINCE OF ONTARIO

Water Works and Sewerage Works

Sealed tenders will be received by the Town Clerk until 8 p.m. on **Tuesday, May 5th, 1914,** for the following works:—

- Contract "A-1"—Laying Water Mains.
- Contract "A-2"—Laying Sewers.
- Contract "C"—Water Tower and Foundations.
- Contract "D"—Water Pipes and Specials.
- Contract "E"—Fire Hydrants, Gate Valves and Valve Boxes.
- Contract "F"—Mechanical Pressure Filters.
- Contract "I"—Intake and Basin.
- Contract "M"—Laying Force Main.
- Contract "S"—Furnishing Sewer Pipes.

Plans and specifications may be seen at the Engineer's office, Mail Building, Toronto, or at the Resident Engineer's office, Wallaceburg, on and after April 11th.

The lowest or any tender not necessarily accepted.

T. B. DUNDAS, Esq., Mayor.
H. E. JOHNSON, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.
14-15

Separate sealed tenders, addressed to the undersigned, will be received at this office until 4 p.m. on **Monday, April 27, 1914,** for the supply of "Brooms and Brushes," "Chain," "Hardware," "Hose," "Oils and Greases," "Packing," "Paint, Paint Oils, etc.," "Manilla Rope," "Wire Rope," and "Steam Pipe, Valves and Fittings," for the departmental dredging plant in Ontario and Quebec.

Each tender must be sent in a separate envelope and endorsed "Tender for Hardware, Ontario and Quebec," "Tender for Chain, Ontario and Quebec," etc., as the case may be.

Tenders will not be considered unless made upon forms furnished by the Department and in accordance with conditions contained therein.

Combined specification and form of tender can be obtained at this Department and at the offices of A. E. Dubuc, Esq., District Engineer, Montreal, Que.; J. E. Sing, Esq., District Engineer, Toronto, Ont.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for the amount mentioned in the tender.

By order,
R. C. DESROCHERS,
Secretary
Department of Public Works,
55673 Ottawa, April 6, 1914 15-16

CITY OF STRATFORD

Sealed tenders will be received by the undersigned up to five o'clock p.m., **Monday, April 20th,** for the construction of:—

12,000 sq. yds. of Concrete Base for Pavements.

3,400 sq. yds. of one course Concrete Pavement.

12,650 lin. ft. of Concrete Curbing.

Specifications and forms for tender may be had from the office of the City Engineer,

A. B. MANSON,
City Engineer.
Stratford, Ont., April 2, 1914. 14-15

Tender for School Building

Tenders for the erection and completion of a Public School on Rawdon Street, Brantford, Ont., according to the plans of Messrs. Taylor and Bodley, architects, will be received by the undersigned up to noon (one o'clock) on **Wednesday, April 22, 1914.** All tenders must be accompanied by a marked cheque for five per cent. of amount of tender.

Form of tender and all information may be obtained at the office of the Architects, 201½ Colborne Street, Brantford, Ont.

15 A. K. BUNNELL, Secretary.

Town of Montreal West

Sealed tenders addressed to the undersigned will be received until 12 o'clock noon on **Tuesday, April 21, 1914,** for paving certain streets or portions of streets in the Town of Montreal West.

Tenders will be received for a general contract.

Each tender must be accompanied by a certified cheque to an amount of 10 per cent. of the total amount of the tender and made payable to the Town of Montreal West.

Plans and specifications can be obtained at the Engineer's office, Town Hall, Town of Montreal West.

The Town does not bind itself to accept the lowest or any tender.

G. F. PATERSON,
Secretary-Treasurer,
15 Town of Montreal West.

Greater Winnipeg Water District

To Contractors

Tenders for Construction of Dyke

Sealed tenders (marked "Tender for Dyke"), addressed to the "Commissioners of the Greater Winnipeg Water District, [illegible] Winnipeg," will be received up to noon of **Friday, May 15th, 1914,** for the construction of a dyke across the end of Indian Bay (an arm of Shoal Lake, Ontario). The dyke will contain about 220,000 yards of fill.

[illegible] of tender and plan will be obtainable, and the form of contract will be on view, at the office of the Commissioners after Monday, March [illegible]

The lowest or any tender not necessarily accepted.

Greater Winnipeg Water District
[illegible]
[illegible]

Winnipeg, March [illegible], 1914 [illegible]

VILLAGE OF JARVIS

Road Contract

[illegible] tenders addressed to the Reeve and [illegible] not later than the [illegible] of April, 1914, will be received by the [illegible] of Jarvis for the construction of 10,624 square yards of "Tarvia filled" or "Rocmac" macadam roads.

[illegible] be accompanied by a marked cheque payable to the Village Treasurer for five per cent. of the amount of the tender.

Specifications for the work and instructions to bidders may be seen at the offices of the Contract Record and of the Canadian Engineer, Toronto, or at the office of the undersigned at Temple Building, Brantford.

Lowest or any tender not necessarily accepted.

ALAN MAIR JACKSON,
15-16 Village Engineer.

CITY OF BERLIN

Tenders for Creosoted Wood Block Pavement

Sealed tenders addressed to A. H. Millar, City Clerk, will be received up to 5 o'clock p.m., April 30th, 1914, for approximately 21,422 sq. yards of Creosoted Wood Block Pavement in the City of Berlin. Plans and specifications may be seen at the office of the "Contract Record" and "Canadian Engineer," Toronto, and at the office of the City Engineer. The lowest or any tender will not necessarily be accepted. 15-17

HERBERT JOHNSTON,
City Engineer.

Tenders Wanted

by the

Board of Education

Windsor, Ont.

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer, will be received until 5 p.m., **Monday, April 27th, 1914**, for the construction of a twelve class room school. Plans and specifications to be seen at the office of J. C. Pennington, architect, LaBelle Block. Each tender must be accompanied by a certified cheque for a sum equal to five per cent. of tender. The lowest or any tender not necessarily accepted.

ALEX. BLACK,
15 Secretary-Treasurer.

CITY OF CALGARY

Sealed tenders addressed to the City Commissioners, and marked "Tender for Sewer Pipe and Segment Blocks," will be received at the office of the City Clerk up to 5 p.m. of **Thursday, April 23, 1914**, for the supply and delivery, in carload lots, f.o.b. Victoria Park, Calgary, and as required by the City from time to time of approximately 150,000 feet of sewer pipe and segment blocks, breakage guaranteed to the City [illegible]

Particulars, information and specifications may be obtained from the office of the City Engineer, City Hall, Calgary.

A marked cheque in the amount of 5 per cent. of the total amount of bid, payable to the City of Calgary, must accompany each tender. Cheques will be returned to unsuccessful tenderers so soon as a contract has been executed.

The City reserves the right to accept or reject any or all tenders in whole or in part or to accept any bid or portion thereof as may be advantageous and to the satisfaction of the City.

J. M. MILLER,
14-15 City Clerk.

Business Opportunity

For Sale Woodworking shop fitted especially for general work such as interior trim, doors, sash, etc. New and up-to-date machinery. First class dry-kiln. Blower system. Railway siding. Situated in a thriving Ontario town. Splendid local and shipping trade.

This is an exceptional chance to buy a bright business with a trade already established.

Write to J. A. C., care Contract Record, Toronto. 15

Tenders for Construction of Sewers

Sealed tenders, plainly marked as to contents, will bt received at the office of the undersigned up to noon of **Monday, April 20th, 1914**, for the construction of Sewers on Ravensden, Kennedy and Barrie Avenues in the Township of York.

Plans, specifications and all necessary information may be seen at the office of Frank Barber, C.E., 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.

Toronto, April 11th, 1914. 15

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, April 28th, 1914**, for the construction of the following

SEWERS

Viz.:

Cairns Avenue, Hemlock Avenue to Pullen Avenue, and on Pullen Avenue, Cairns Avenue to Wrenson Road.

Claude Avenue, Queen Street to Merrick Ave.

Edna Ave., Woodville Ave. to Indian Road.

Erie Terrace, Queen St. to Gerrard Street.

Gerrard St., E.S. Leslie St. to 792 ft. east.

Glendale Avenue, Queen Street to north limit Lot No. 169.

Glenmanor Drive, Queen Street to south limit Lot No. 11.

Glenmanor Drive west, south limit Lot No. 11 to Williamson Road.

Indian Road, Bloor St. to Conduit Street.

Indian Road Cres., Indian Road to Conduit St.

Lane first north College Street, Ossington Ave. to Concord Avenue.

Lane first south Dundas Street, west side Grove Avenue to west end.

Lane first north Geary Avenue, Dovercourt Road to Westmoreland Avenue.

Lane second north Queen Street, Cameron Avenue to west end, thence north to north end.

Lane first west Roxton Road, Harbord Street to north end.

Merrick street, Indian Road to Glendale Ave.

Midway district drainage scheme outlet from Gerrard Street and Eighth Avenue, to Copeland avenue and Roseheath Avenue via Eighth Ave., Lot No. 181 G. T. R., Block B., Hillingdon Avenue, Hanson Street, Lot 143, Lot No. 63, and Roseheath Avenue, and on Eighth Avenue, from outlet to 500 feet east of Seventh Avenue.

Patterson Ave., Indian Road to Glendale Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties, approved of by the City Treasurer, or, in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid. Conditions relating to tendering as prescribed by City Bylaw, must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control

Toronto, April 11th, 1914.

City of Stratford

Sealed tenders will be received by the undersigned up to five o'clock p.m. on **Saturday, April 25th inst.**, for the construction of approximately:

1,650 ft. of 5½-ft. Concrete Storm Sewer Arch.

2,940 ft. of 2-ft. Vitrified Glazed Pipe Sanitary Sewer.

Plans, profiles, specifications and all necessary information may be obtained from the office of the City Engineer.

The lowest or any tender not necessarily accepted.

A. B. MANSON,
15 City Engineer.

Contractors' Outfit For Sale

Suitable for Sewer and Water Works Construction

One Parsons Trenching Machine, Concrete Mixers, pumps, trench braces and other tools, being a complete outfit.

Can be seen at Prince Albert, Sask., Canada. Information, write

HUGO & TIMS COMPANY,
14-17 Duluth, Minn.

Asphalt Plant

Sealed tenders will be received up to 4 p.m., **Thursday, April 30, 1914**, for a semi-portable asphalt plant for the Corporation of the city of Victoria, B.C. Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted. 11-15

Town Engineer Wanted

Town of Sudbury, Ontario

Applications will be received by the undersigned until 6 p.m., **Saturday, April 25th, 1914**, for the position of Consulting Engineer for the Town of Sudbury, on a salary basis and percentage, for paving and other work to be done during 1914.

Applicants will please state experience, when available, salary and percentage required.

W. J. ROSS, Town Clerk.

Dated at Sudbury,
This 7th day of April, 1914. 15-16

Public Notice

Re Position of Asphalt Superintendent

Applications addressed to the Chairman and Members of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control, up to 4 p.m., **Tuesday, April 28th, 1914**, for the position of Asphalt Superintendent and Inspector. Said Superintendent to be able to make asphalt analysis and to be thoroughly experienced in asphalt work.

Applicants are requested to state their age, experience and salary expected.

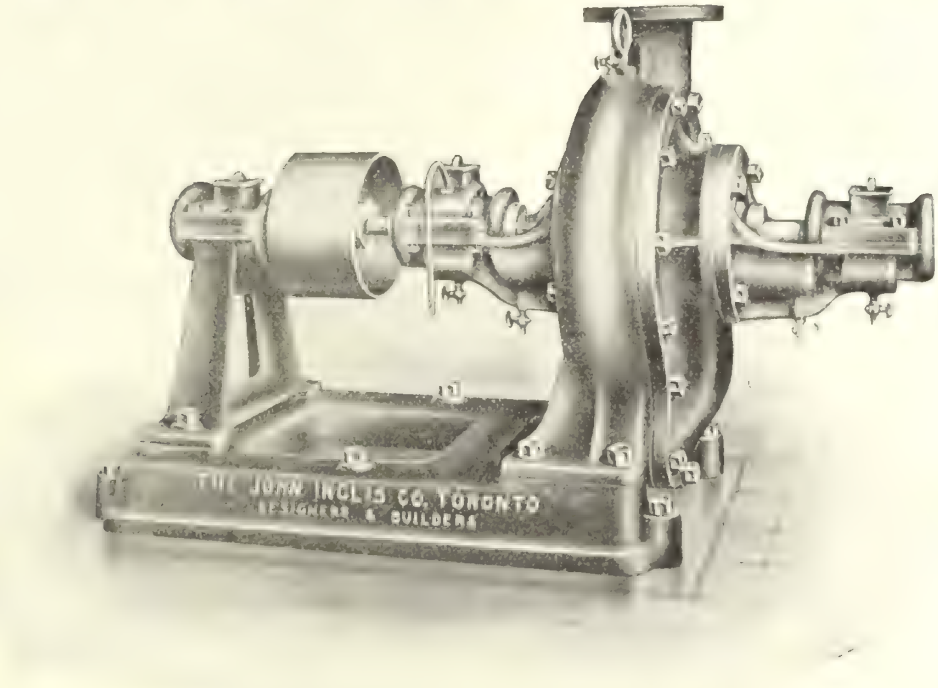
ARCH CURRIE,
City Engineer.

Ottawa, April 8th, 1914. 15-16

Positions Wanted

To Architects.—Superintendent of works is open for re-engagement. Familiar with all kinds of office buildings, schools, banks and hospitals. Ready to take charge of works at once. Reply "Superintendent," Contract Record, Toronto. 15-16

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office, Room 509 Canadian Express Building

Business Notes

(Continued from page 81)

niture and tobacco, loss $9,000; C. V. [illegible], [illegible], loss $10,000; N. K. [illegible] [illegible] store, loss $6,000

London, Ont.

A [illegible] [illegible] at the premises of the Dominion Abattoir, Ltd., London Junction, [illegible] the stock house, involving a loss of $10,000

Ottawa, Ont.

The stores and apartments occupied by Frank Jarman, artists' supplies, S. McClennagan, A. G. Acres, real estate, and R. King, farrow, have been destroyed by fire. Loss $25,000, covered by insurance.

Saskatoon, Sask.

The business block owned by H. Devere Cole, London, England, has been destroyed by fire, the building was occupied by Westhaver Hardware Co., loss $40,000, insurance $40,000; H. Tuppling, men's furnishings, lass $40,000, insurance $30,000; Elliott Drug Store, lass $18,000, insurance $12,000. The loss to the building was $70,000 which was covered.

Toronto, Ont.

The tannery of H. B. Johnston & Co., Wilton Ave. and River St., has been damaged by fire to the extent of $10,000.

The factory of the Allan Mfg. Co., Simcoe St., has been destroyed by fire. The loss is estimated at $25,000.

A fire at the Toronto & York Radial Rly. car barn at Sunnyside, recently occurred, when in addition to the damage of $5,000 to the building, 2 cars valued at $12,000 were destroyed.

Timmins, Ont.

A recent fire at the Hollinger Mines, Ltd., destroyed the bunk house, dining room, etc. Loss $6,000.

Tomiko, Ont.

The sawmill of Ferguson & McFadden has been destroyed by fire. Loss [illegible]

Vancouver, B.C.

A disastrous fire has destroyed the warehouse of Nelson, Shakespeare, Watkins, Ltd., wholesale grocers. The building is also occupied by Standard Brokerage Co., Turner Bros., Canada, Ltd., Asbestos Manufacturing Co., McLeod & Clarkson, Imperial Storage Co., and The Power Canada Co. The total loss is estimated at $600,000.

Victoria, B.C.

The Esquimalt Hotel has been destroyed by fire. the loss, $10,000, was partly covered by insurance.

Winnipeg, Man.

The destruction by fire of an office building, on Main St., affected the following firms. Canadian Northern Rly., Rembrant Co., photographers, Western Investment Co., Western Woodenware Co., Winnipeg Scenic Co., Sanitary Supply Co., MacKenzie & Mann Telegraph Co., Harvey Bros., manufacturers, Gate City Brick Works, North Empire Fire Insurance Co. The total loss is placed [illegible]

New Companies

R. J. Williams & Brothers, Ltd., has been incorporated with a capital of $20,000, with head office at Saint Lambert, Que., to carry on business as sanitary and electrical engineers, plumbers, etc. The provisional directors are R. J. Williams and W. Williams, of Saint Lambert, Que., and G. L. Williams, A. Ramsay, and G. E. Neville, of Montreal.

Bernard Construction Co., Ltd., has been incorporated with a capital of $20,000, with head office at Montreal. The provisional directors are L. A. and L. J. Bernard, J. Turcotte, E. Parent and A. Lacaillade, all of Montreal.

Greater Ottawa Stone and Concrete Ltd., has been incorporated with a capital of $100,000, with head office at Ottawa. The provisional directors are B. Boutet, C. Lapierre and A. Lapierre, of Ottawa.

Cairnie and St. George Ltd., has been incorporated with a capital of $200,000, with head office at Montreal, to carry on business as general contractors. The provisional directors are L. McD. Cairnie, and H. L. St. George, of Montreal; H. D. Lawrence and Wm. Morries, K.C., of Sherbrooke, Que.

C. J. Dryden Co., Ltd., has been incorporated with a capital of $25,000, with head office at Westmount, Que., to carry on business as general contractors. The provisional directors are C. J. Dryden and N. C. Brown, of Westmount, Que., H. C. Wallace and R. H. Somers, of Montreal.

The Summit Engineering Co., Ltd., has been incorporated with a capital of $50,000, with head office at Calgary, Alta.

The Cast Stone Construction Co., Ltd., has been incorporated with a capital of $25,000, with head office at Edmonton, Alta.

The Jamieson Construction Company, Limited, has been incorporated with a capital of $25,000, with head office at Edmonton, Alta.

The Alberta Construction Co .,Ltd., has been incorporated with a capital of $10,000, with head office at Edmonton, Alta.

The Saint John Sand and Gravel Co., Ltd., has been incorporated with a capital of $24,000, with head office at St. John, N.B. The provisional directors are F. R. Fairweather, A. J. Wheaton, J. C. Chesley, R. M. Rive and H. A. Porter, all of St. John, N.B.

The Kingston Construction Co., Ltd., has been incorporated with a capital of $50,000, with head o ce at Kingston, Ont. The provisional directors are G. C. Wright, A. S. Campbell, G. Bawden and H. E. Richardson, of Kingston, and W. H. Harvey, of Deseronto, Ont.

Chick Contracting Company, Limited has been incorporated with a capital of $100,000, with head office at Windsor, Ont. The provisional directors are T. and J. D. Chick, and E. Wigle, of Windsor, Ont.

The Tierney Construction Company, Limited, has been incorporated with a capital of $100,000, with head office at Ottawa, Ont. The provisional directors are R. J. Tierney, A. J. Fraser and C. H. Maclaren, of Ottawa.

The Farrell Engineering Company, Limited, has been incorporated with a capital of $40,000, with head office at North Bay, Ont. The provisional directors are J. B. Stewart and E. C. Rheaume, both of North Bay, Ont.

William Markus, Limited, has been incorporated with a capital of $40,000, with head office at Pembroke, Ont., to carry on business as general contractors. The provisional directors are W. Markus, J. H. Bruck and J. T. Stuart.

The Cataract Junction Sand and Gravel Company, Limited, has been incorporated with a capital of $50,000, with head office at Toronto. A. V. Trimble, E. F. Latimer, W. G. Hewson, A. C. Goodwin and A. H. McBride.

The Luxfer Prism Company, Ltd., has been incorporated with a capital of $90,000, with head office at Toronto. The provisional directors are W. Cowan, T. W. Horn, and C. M. Cannoff, of Toronto.

James Devonshire, Limited, has been incorporated with a capital of $40,000, with head office at Toronto, to carry on business as electrical engineers. The provisional directors are W. L. Gordon, J. S. Duggan, C. A. St. C. McKay. R. H. Green, and H. E. Maning, all of Toronto.

Whyte Foundry Co., Ltd., has been incorporated with a capital of $49,000, with head office at Toronto. The provisional directors are J. A. Kent, C. W. Thompson, J. M. Langstaff and J. H. McDonald, all of Toronto.

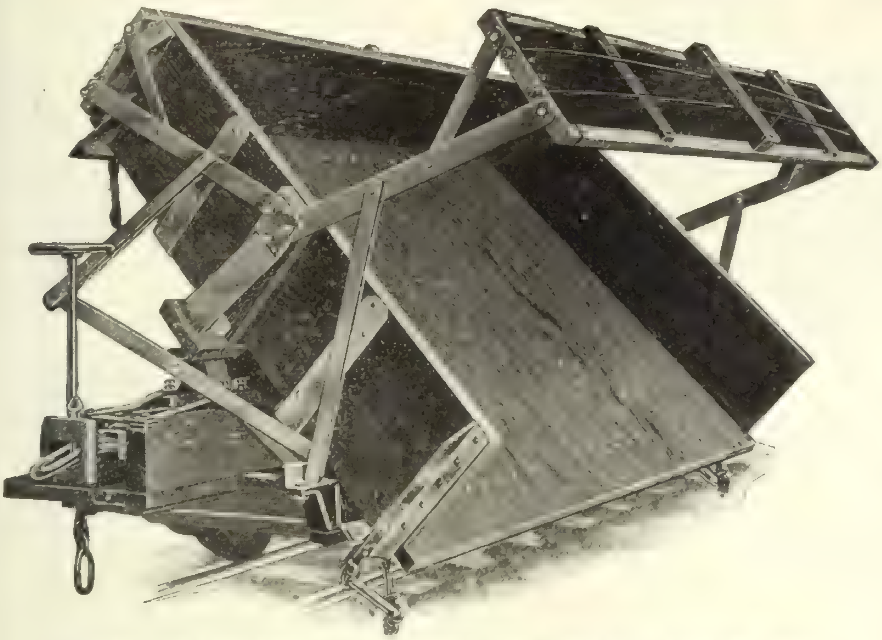
Carlton Construction Co., Ltd., has been incorporated with a capital of $100,000, with head office at Ottawa. The provisional directors are A. Robertson, R. A. Bingham and W. J. Sims, contractors, and Louis Cote and T. A. Burgess, barristers, all of Ottawa.

Interprovincial Brick Company of Canada, Limited, has been incorporated with a capital of $500,000, with head office at Montreal, Que. The provisional directors are R. T. Heneker, K.C., W. S. Johnson, E. J. Waterston and C. S. Le Mesurier, advocate, all of Montreal.

The Oliver Rogers Stone Company, Limited, has been incorporated with a capital of $60,000, with head office at Owen Sound, Ont. The provisional directors are S. J. Oliver and W. J. Carnahan, quarrymen; W. F. Rogers and F. Rogers, builders' merchants, of Toronto.

Ontario Sand Company, Limited, has been incorporated with a capital of $45,000, with head office at Niagara Falls, Ont. The provisional directors are W. W. Read, contractor, Niagara Falls, U. S. A., F. A. Douglas and D. B. White, of Niagara Falls, Ont.

IF YOUR BUSINESS ISN'T WORTH ADVERTISING, ADVERTISE IT FOR SALE



Cut showing 4 and 6 yard Double Diamond Steel Frame Car. Our best efforts have been given to these cars for the past year.

We invite the enquiry of all contractors who intend purchasing steel frame equipment now or later. It will pay you to write us at once for full particulars. PRICES RIGHT.

GLENGARRY

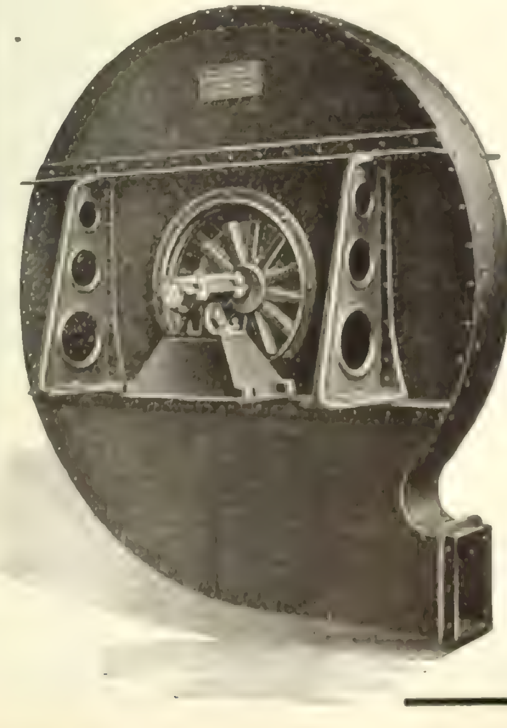
You Simply Can't Beat This Car For Dumping!

The wonderfully simple plain dumper irons are at work! Note the door opening and clearance. "GLENGARRY" cars are well up front on every point' In fact we can demonstrate superior points to any other competitor. Strong boxes well supported and end braced. Perfectly trussed diamond frames and drawbars and thoroughly well designed construction are points you want in your new cars. Write us for specifications. Watch next week's issue!

The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

Your Cupola — Are You Giving it a Fair Chance?

Is it assisted by a Blower that provides for perfect combustion of the fuel?
Does it produce sufficient pressure to overcome the resistance within the cupola?



"Sirocco" TRADE MARK. **Special Steel Pressure Blowers**

do these all-important things and at a lower cost for power than blowers of other types or even of the same type.
There are no frictional surfaces to "eat up" power in a "Sirocco" Blower. The bearings are self-aligning and self-oiling. Being independent of the housing prevents vibration. The speeds of "Sirocco" Blowers are adaptable to direct connection to electric motors and steam turbines, thereby eliminating the usual belt and gear power losses.
Every ounce of energy put into a "Sirrocco" Special Steel Pressure Blower goes to propelling air.

Write for Bulletin No. 8. It contains helpful information on Pressure Blowers

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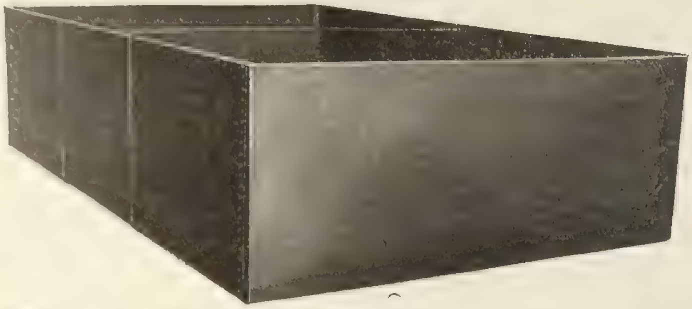
We Specialize in This Class of Work.

Any Shape or Size.

All Workmanship Guaranteed.



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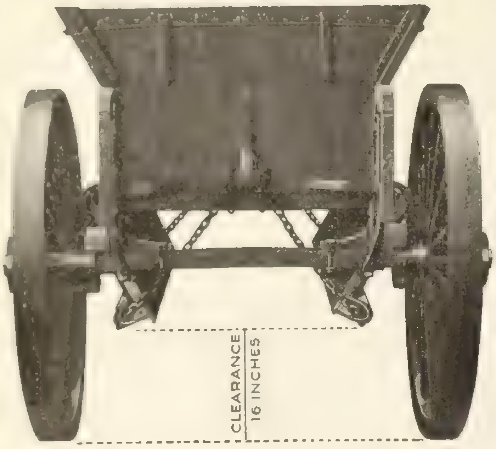

in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

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Sand-Lime Brick

MADE from clean, pure silica sand and the highest grade calcium lime by the most up-to-date equipment. The result is a brick from outside to core, uniform in density, strength and size.

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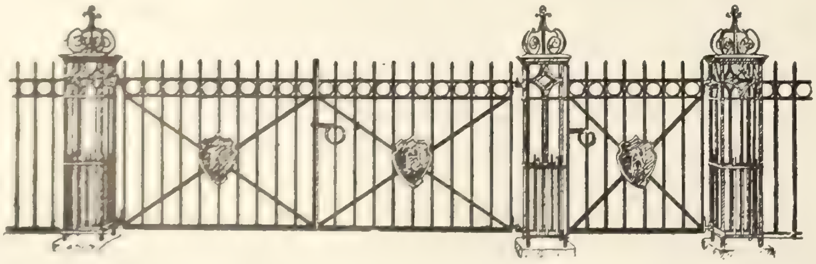

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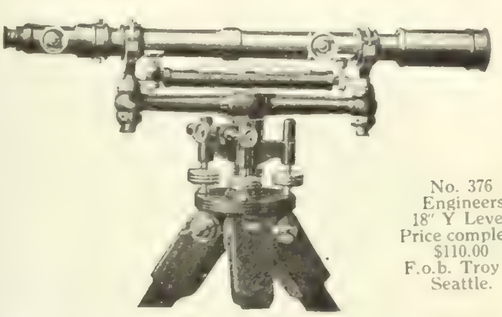
MEADOWS BLOCK, WELLINGTON ST. WEST



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$110.00
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Gurley Levels

Are universally preferred by Engineers and Surveyors on account of their Accuracy, Stability and Permanency of Adjustment.

Made in five sizes, with telescopes 22, 20, 18, 15 and 6½ inches in length, and priced from $115 to $50, f.o.b. Troy or Seattle.

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All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

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With our unequalled shipping facilities we can make prompt deliveries to any point.

Satisfaction guaranteed

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1—1 yd. Smith Concrete Mixer
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1—12 h.p. Portable Boiler and Engine
5 Steel Skips
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4 Derricks & Derrick Irons
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All in good condition. Full particulars and prices on application.

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Structural steel painted with "Superior Graphite Paint"

PROTECTION
for ALL kinds
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Guaranteed
by using
"SUPERIOR
GRAPHITE
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Penstocks
Developing 96,000 horse power, painted with "Superior Penstock Paints."

The most economical paint that can be used when maintenance cost is considered, for

BRIDGES
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Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

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We also manufacture

SKYLIGHTS, CORNICE, FIRE DOORS AND WINDOWS, TIN CLAD DOORS, ASPHALTS, TARRED AND DRY FELTS, COAL TAR PITCH

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of all designs in both iron and steel; Roofs, Telephone Poles, House Girders and all kinds of Structural Iron Work.

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Frost-Proof
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Main Structural Shop: 130 ft. x 400 ft.
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Capacity: 18,000 Tons Annually

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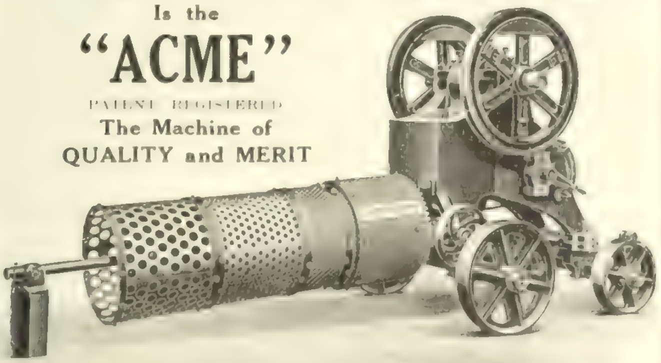
WELLAND - CANADA
MANUFACTURERS AND ERECTORS
STEEL BUILDINGS AND BRIDGES



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The Machine of
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ENAMELED BRICK

Sanitary and Impervious

Adaptable for all kinds of building where the highest standard of brick perfection is demanded.

Write for information.

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Structural Steel of All Kinds

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Beams, Channels, Angles, Plates
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STANDARD FIRE-PROOF DOORS

INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

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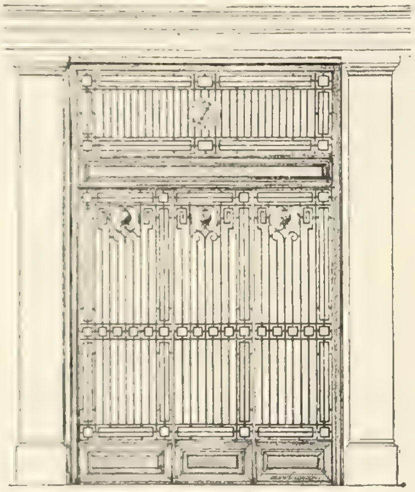

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Artistic designing and competent execution by experienced workmen makes every Dennis elevator job a handsome, competent piece of work.

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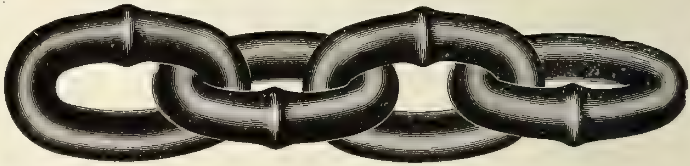

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Size in inches	5/8	3/4
Links per foot	6	5 1/3
Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
Breaking Test	26,000 lbs.	36,000 lbs.
Working Load	8,000 lbs.	11,000 lbs.

Made in Canada × **25% Stronger** × **Sold by Jobbers**

McKinnon Chain Company
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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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of all types and sizes, Heaters, Tanks, Pumps, etc.

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Turbine Pumps

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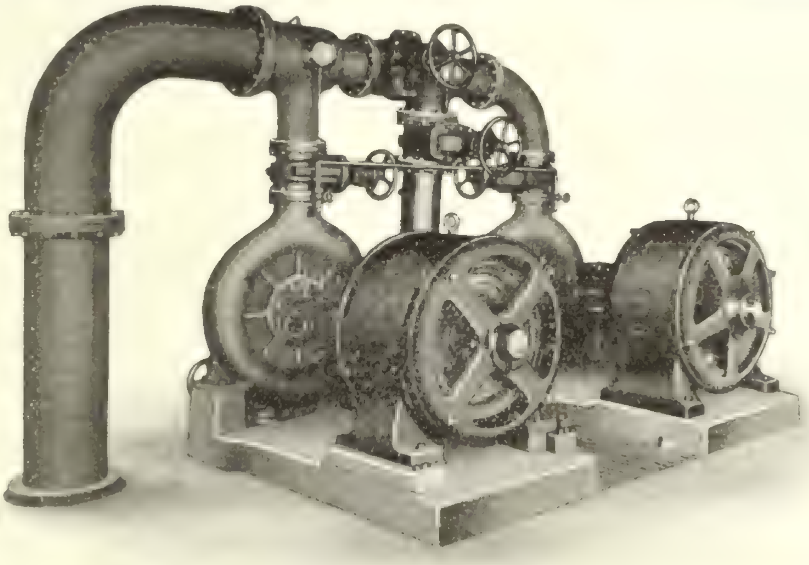
Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants

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If we can successfully handle these camps does it not seem that we could handle yours?

We can save you money, and relieve you of the necessary worry connected with running your own camps. Write us for proposition.

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IF only because of the great saving in freedom from bats and culls and breakage in handling, our brick would appeal to every wideawake builder.

Add to this absolute uniformity in size and color, great crushing strength and low absorption qualities, prompt delivery in A1 condition and you need look no further for the reason of their popularity with those who have used them.

Look for the YSB stock mark.

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Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

Put up in bags ready for immediate use by mixing with water only.

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Screened Sand and Gravel

Largest Producers, Noted for Prompt Shipment.

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Smyth & Ryan
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means prompt delivery and high grade materials at standard prices.

WE CAN SUPPLY YOU WITH EVERYTHING THAT GOES INTO YOUR BUILDING, EXCEPT THE IRON AND LUMBER

Toronto Agents for
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Deliveries—G.T.R. and C.P.R.

Special Attention to Sand and Gravel Orders

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5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

When completed this will be the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally situated
- Light on four sides
- Passenger and freight elevator
- Vaults
- Low insurance
- One block from four car lines
- Floor area, 6,300 sq. feet, each floor.
- Building ready for occupancy May 15th.

For further particulars ask

R. A. Donald

Union Bank Building - Toronto

> "It is with a great deal of satisfaction that we can recommend the turbine which we purchased from the B. F. Sturtevant Company in the strongest possible manner.
>
> The 20 K.W. unit has been in operation for the past two years and has given us perfect service without any exception.
>
> Hoping this is satisfactory and asking that you advise if we can be of further assistance, we remain."

The letter quoted above was written by a large Western Manufacturer to a Western Lumber Company in response to a request for their opinion of the Sturtevant Turbine. The names of both these companies will be furnished on request.

Could a stronger recommendation of the Sturtevant Turbine be written? Two years of "perfect service without exception" and the Sturtevant Steam Turbine will continue to give this perfect service for years to come.

Sturtevant

(REG. CAN. PAT. OFF.)

Steam Turbines

are small users of steam, the forged steel solid rotor with milled-in buckets and the special nozzles and reversing chambers insure this. They are durable, the solid rotor can't wear out or fly to pieces. They are simple, there is nothing about them that can give trouble. Sturtevant Geared Turbine is adapted for driving any apparatus at any speed efficiently.

It will pay you to investigate this somewhat different turbine.

Ask for Catalog 210-Z

B. F. Sturtevant Company of Canada, Limited

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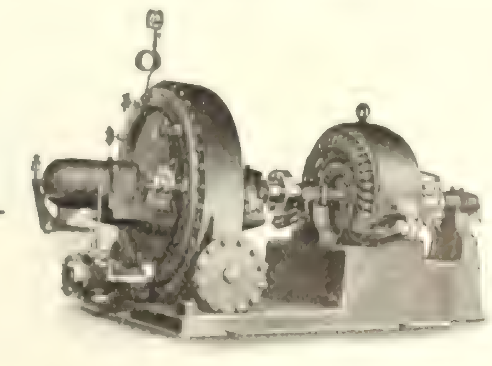
SALES OFFICE FOR EASTERN CANADA
919 New Birks Building, Montreal

Selling Agents for Sanford Riley Stoker Company, Limited,
"THE RILEY STOKER"



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Structural and Steel Plate Work

is our specialty. We fabricate and erect from your drawings, or will design your structure for you.

No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

WALSH PLATE & STRUCTURAL WORKS, LIMITED

Drummondville, Que. Holyoke, Mass.

The Maritime Bridge Company, Limited

Successors to

Wm. P. McNeil & Company, Limited

Manufacturers of

Bridges—Steel Buildings
Roof Trusses — Turntables
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Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, New Glasgow, N. S.

A STEAM SEPARATOR

of the receiver type is a difficult piece of plate work to make absolutely and permanently tight. That is the reason why we developed our Welded Separator—not a single rivet in its construction, every joint and seam being a perfect weld. The shell is lap welded, the heads are set in by our patented Line Weld method and the necks are attached by our patented Interlock method.

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PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION CO.
PITTSBURGH, PA.
ENGINEERS FOUNDERS MACHINISTS
ATWOOD

JAMES THOMSON, President. J. G. ALLAN, Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

The Canada Iron Corporation, Limited

Head Office:
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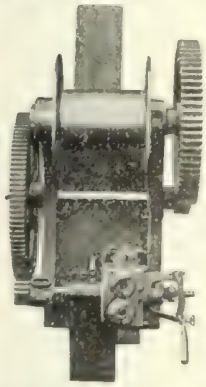
MONTREAL

Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The DAKE

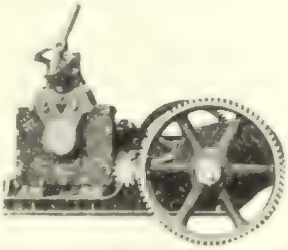


HOISTING ENGINES
STEAM CRANE HOISTS
MOTOR CRABS
SWINGING ENGINES

Write for catalog and prices

Dake Engine Co.
Grand Haven, Mich.

Montreal Agents:
Mussens Ltd.



We are now in a position to offer

"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

The Queenston Quarry Co., Ltd.
ST. DAVIDS, ONT.

White Sparkling

Crushed Granilite

Graded in Several Sizes for concrete work. This is the Best material for facing Artificial Stone, Monolithic Work, Stucco, Floors, Sidewalks, Surfacing Cement Bricks, etc. Concrete made with this Material is Strong, Dense, Moisture-Repelling and looks like Natural Granite. Samples on Request.

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"Galvaduct" and "Loricated"

Conduits

for Interior Construction

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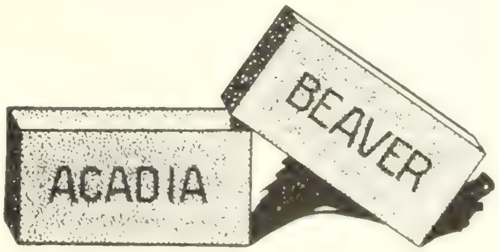

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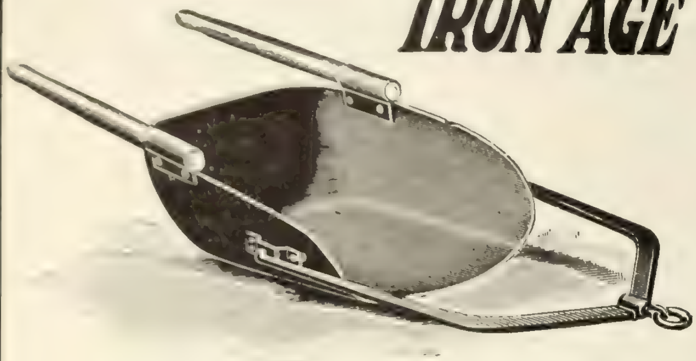

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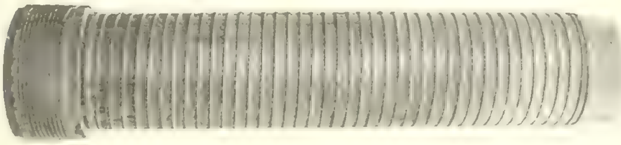

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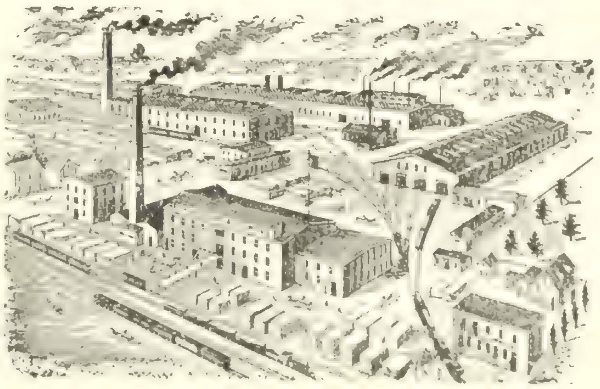

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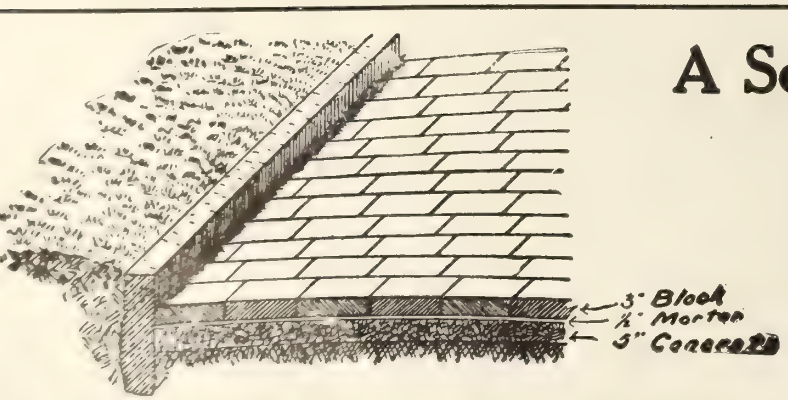

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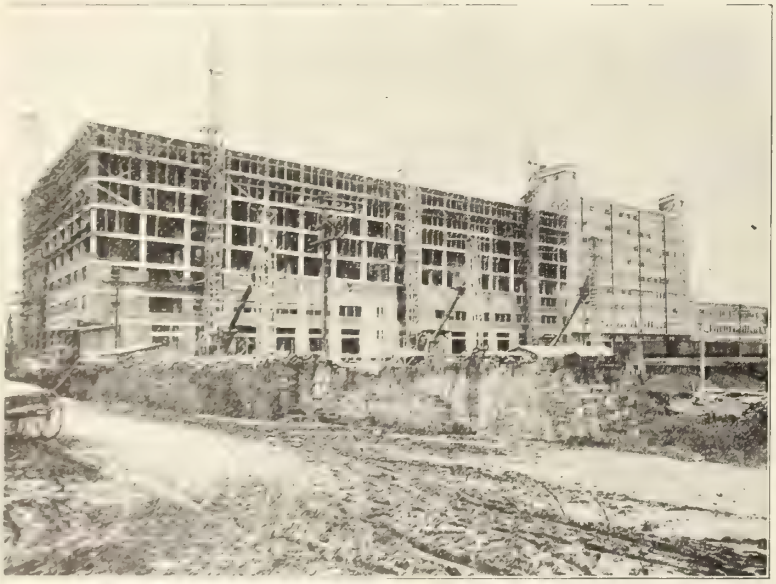

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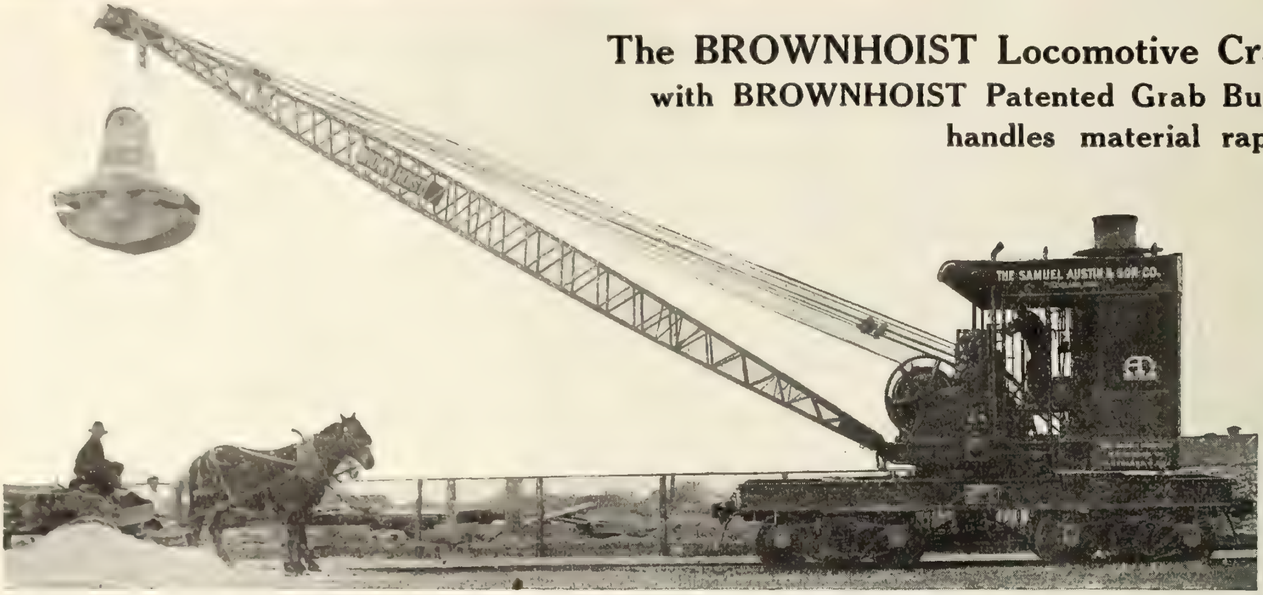
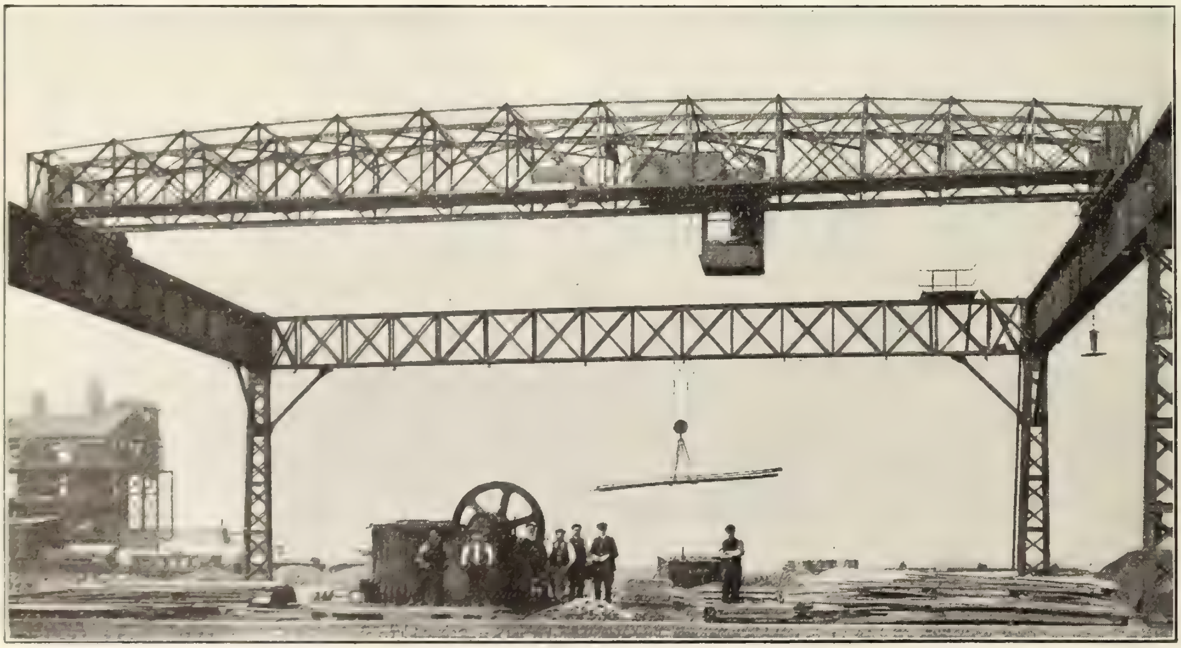


Operated by one man, this crane with bucket handles coal, ore, crushed stone, sand, gravel, etc., 60 to 120 tons per hour, from and to cars, wagons, bins and stock pile. And Brownhoist Locomotive Cranes are built for hard and continuous service—thereby saving the owner costly delays and repairs due to frequent breakdowns. Ask the owners—they will tell you.

Write for catalog K which shows how and where this crane and bucket are being used.

THE BROWN HOISTING MACHINERY CO., CLEVELAND, OHIO
NEW YORK PITTSBURGH CHICAGO SAN FRANCISCO PORTLAND, ORE., The Colby Engineering Co.



Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

Royce
Electrical
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Include Royce Crane Type Motors, Controllers, Over Hoisting Safeguard.

YOUR ENQUIRIES ARE SOLICITED FOR
CRANES TELFERS CAPSTANS WINCHES

ROYCE, LTD., Trafford Park, Manchester, England

THE H. & E. PATENT BALL-BEARING LIFTING JACK

For Railway and Bridge Work, Contractors' and Builders' Use

Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

Manufactured by

CANADIAN BRAKESHOE CO., LIMITED
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Sole representatives for the sale of our Brakeshoes in the Dominion of Canada outside British Columbia — Messrs. Taylor & Arnold, Montreal and Winnipeg. The Province of British Columbia—The B. C. Equipment Co., Vancouver.

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to pass us by before getting our prices on your requirements or before putting in your tenders on

Plate Sheet Fancy

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The

Consolidated Plate Glass Co.

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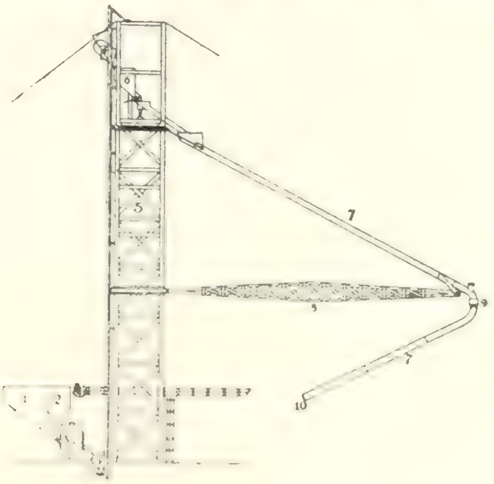

Gravity System
Distributing Concrete

A system that improves the concrete and reduces the cost.

Information gladly furnished and Estimates given on any work.

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Roelofson Elevator Works

Manufacturers of

FREIGHT AND PASSENGER

ELEVATORS

ELECTRIC, HYDRAULIC, HAND POWER

Dumb Waiters, Motors and Controllers

Galt, Ontario

Not only is SAFETY FIRST,

in the Ric-wiL method of insulating underground steam pipes but EVERY NECESSARY ESSENTIAL in covering underground pipes.

The system with the INTERLOCKING BASE DRAIN which, with the tile, is the most COMPACT insulating method

Tile and Insulation Are In One Piece

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THE Ric-wiL UNDERGROUND PIPE COVERING CO.

66 New England Bldg.,
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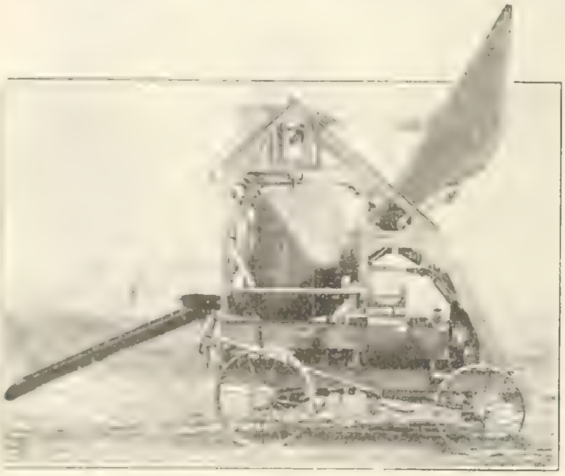
Canadian [illegible] Agencies Ltd., Toronto and Montreal

This New Austin Cube Mixer

For Street and Road Paving



is a one man machine and reduces concrete road construction to its simplest terms. You cannot make the maximum profit or compete successfully if your mixer is not of the right design to suit the job.

This new **Austin Cube** is built to do certain classes of street and road mixing more economically than the larger types—but remember the mixing principle is the same. It is the cube shaped drum that does the work and is the same as found in the **Austin Improved Cube Mixers** which were used for the principal part of the concrete mixing for the Miraflores, Gatun and Pedro Miguel Dams at Panama.

One man can operate it, mix and deliver 1000 square yards of 6 inch concrete per day.

The same gasoline engine which does the work will propel the machine forward or backward at about 2 miles per hour. The total weight of the machine is 11,000 lbs. The chute through which the concrete is distributed is 10 ft. long and this may be reduced to a length of 8 or 6 ft. without stopping the machine.

Ask our Canadian Representatives

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CANADIAN EQUIPMENT & SUPPLY CO., Calgary E. G. CULLEN, Vancouver

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Eastern Office: 90 West Street, New York City **Main Office: Railway Exchange Bldg., Chicago, U. S. A.**

Difficult Earth Moving Problems Have Been Repeatedly Solved

By using the SHEARER & MAYER

Dragline Cableway Excavator

Patented and manufactured in United States and Canada.

The most economical machine on the market for many kinds of excavation and stripping work.

It will excavate, elevate, convey and dump the material in one continuous forward operation under **positive control** of one operator.

Operated with a double drum hoist. Operates with equal efficiency from wet or dry excavation.

The above illustration shows our excavator digging heavy material for back filling a retaining wall. The lower illustration shows the bucket dumping ballast direct into cars.

These illustrations are but two of the many different classes of excavation to which this machine has been successfully applied. It has a large radius of operation and wide range of adaptability.

All parts have been specially designed to reduce the wearing parts to a minimum and to meet the heavy work to which the machine is subjected.

Write us your conditions and requirements and we will advise you.

SAUERMAN BROS. 1140 Monadnock Block, CHICAGO, ILL.

Dragline Cableway Engineers and Selling Agents.

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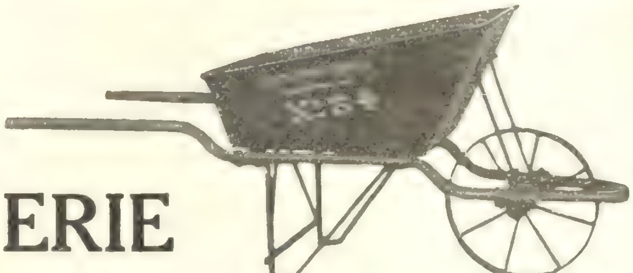
All Steel

"Erie" Barrow No. 23 has a solid welded steel tray of uniform thickness and great strength. The handles are given an extra bend to put tray load more over wheel.

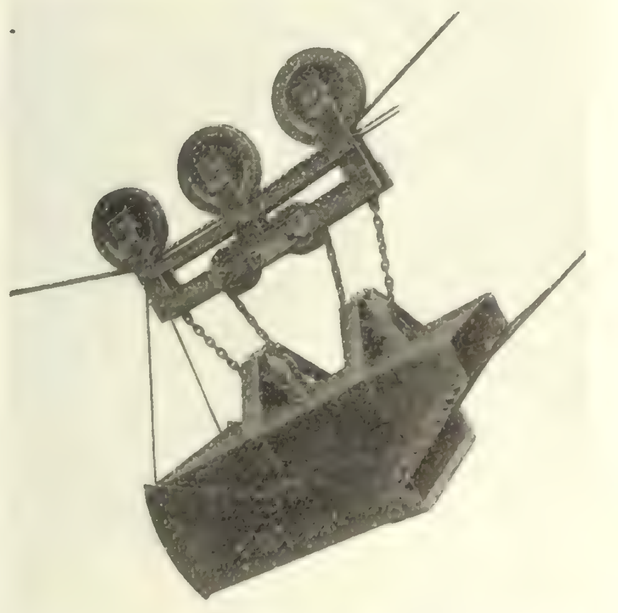


ERIE

This is a deep barrow for carrying concrete or other sloppy material. Wheel guarded and forward dump.

THE ERIE IRON WORKS, LTD., ST. THOMAS

THE DULL DRAG LINE EXCAVATOR



Are you about to commence a contract embracing any rehandling or stripping operations? Dull's Drag Line Excavator with Rear Dumping Bucket may save you money. We will gladly send you complete description and prices.

OPERATING costs are reduced and working speed increased by the improved design of the Drag Line Excavator of gravity return type built by Dull.

These excavators are particularly adapted to preliminary stripping operations before beginning excavating, as the buckets are arranged to discharge at any point along the main cable.

The great economy feature of our excavators is that they discharge with a minimum amount of power and with less strain on the ropes and hoist.

Dull's Rear Dumping Bucket for Drag Line Excavator, shown in illustration, has in a brief time become a very popular piece of equipment on rehandling and stripping work. It is obvious that a bucket that dumps without requiring the additional operation of turning it over—saves power and time and reduces expense of upkeep.

Representatives Wanted
In All Principal Cities.

The Raymond W. Dull Co., 719 Chamber of Commerce Bldg., Chicago, Ill.

Reinforced Standard 2,500 lbs. capacity with geared winch. Complete $48.00, or for Hand and Power $50.00.

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Our Prices are Right and our Derricks the Best on the Market.
Your enquiries will be appreciated : : : :

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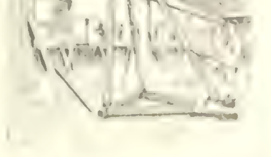

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Structural Waterproofing, Engineers and Contractors
TORONTO, CANADA

Let Us Tender on Your Roofing, Waterproofing and Flooring Specifications

We supply ROOFING, WATERPROOFING and INSULATING MATERIALS, and undertake contracts for Roofing, Waterproofing, Tar Rock, and Mastic Asphalt Flooring. Our Complete Equipment enables us to execute the work in accordance with Architect's and Engineer's Specifications.

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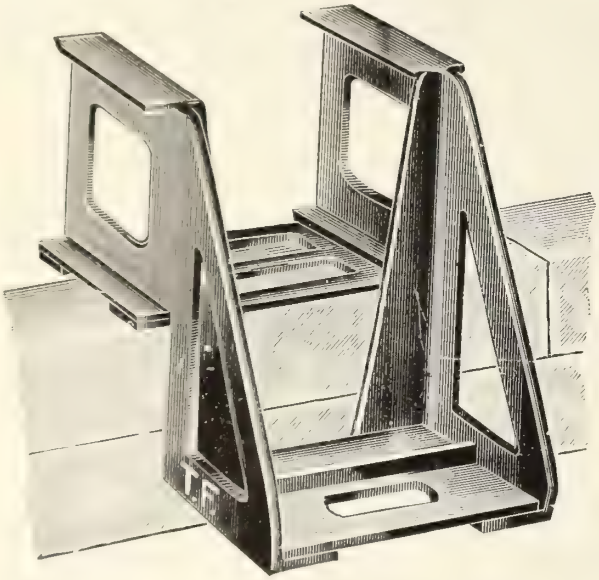

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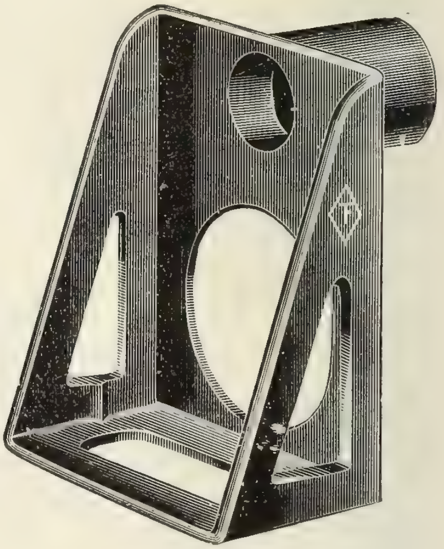
We are the only makers of this line in Canada.



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Water Filters
1,000 to 1,000,000 Gallons a Day

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1/4 to 60 Ton Daily Capacity

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Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
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A few dollars spent in advertising your proposals in the

Contract Record
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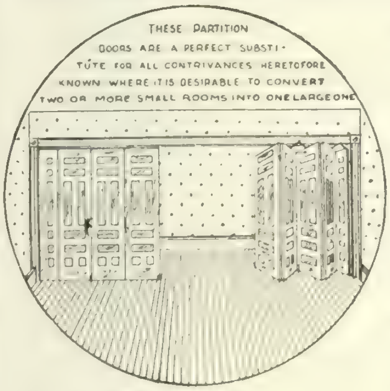
would result in additional competition, which might save your city or town or your client many hundreds of dollars.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No track required on floor.
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"Sterling" Rubber Insulated Wire

is a high grade N.E.C. wire which is guaranteed by many years of successful service. It is specified and used by architects, engineers and contractors of many high grade buildings, one of which is shown below.

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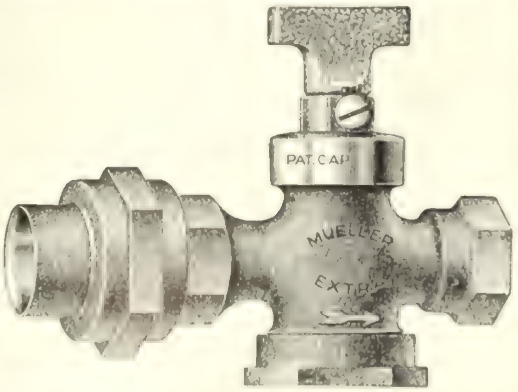
Mueller Lead Flange Curb Cock



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A quick, simple, reliable connection. Curb cocks and corporation cocks in all sizes. These goods are made of Mueller Red Brass—85% Copper—carefully machined and tested under 200 pounds hydraulic pressure. Used by all particular water works companies.

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Makers of high grade Unconditionally Guaranteed Brass Goods.

"Buffalo" Fans

For Heating, Ventilating, Drying and Exhausting.

Ask our engineers to recommend the fan best suited to your requirements. Our designs include the new high-efficiency "*Conoidal*" multiblade fan, used extensively for heating systems, mine and tunnel ventilation, and the motor-driven *Steel Plate Pressure Blower*, giving pressures up to 24 oz. Both of these designs show higher efficiency than obtained with any similar types. We specialize in *direct-connected* units (motor, engine or turbine driven) for every service. These are distinguished by absence of belt troubles and the very lowest power consumption. Whatever your problem write us.

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FOR
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The following books are offered at special prices subject to previous sale:

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Strength of Materials, by Edward H. Maurer. Published in 1908 by American School of Correspondence. 128 pages. Illustrated. Price 75c.

The Modern Asphalt Pavement, by Clifford Richardson. Published in 1910 by John Wiley & Sons, New York. 630 pages; illustrated. Price $2.00.

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Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price $1.00.

Asphalt Construction for Pavements and Highways, by Clifford Richardson. Published in 1913 by McGraw-Hill Book Company, New York. 156 pages. Illustrated. Price $1.50.

Concretes, Cements, Mortars, Plasters and Stucco, by Fred T. Hodgson. Published in 1906 by Frederick J. Drake & Co., Chicago. 520 pages. Price $1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

Specifications for Street Roadway Pavements, by S. Whinery. Published in 1913 by McGraw-Hill Book Company, New York. 116 pages. Price 75c.

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This building was wired with "30 PARA" Rubber Insulated Wire.

Architect: J. H. G. Russell, Winnipeg.
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Address our nearest office

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Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

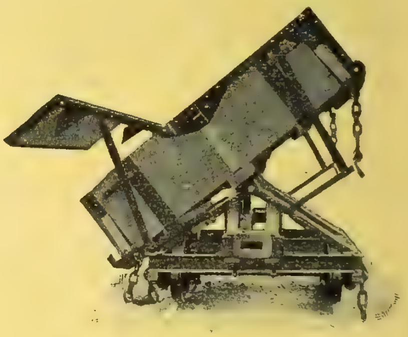
Brickyards, Quarries, Mines, Contractors, etc.

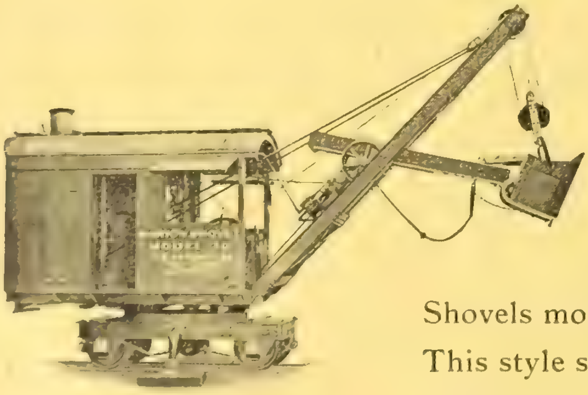
All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.





"MARION" STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
5/8 - 1 and 1 1/2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks. This style shovel is specially adapted for Brickyards—Mines—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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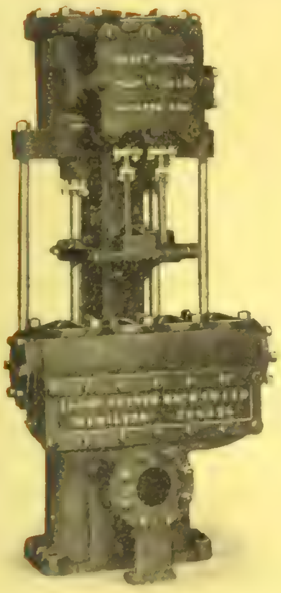
Vol. 28 Toronto, April 22, 1914 No. 16

Contract Record and Engineering Review

ESTABLISHED 1886



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when in the market for

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Stock of pumps carried by
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"MADE IN CANADA"

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Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
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Head Office and Works: 91 to 133 Don Roadway
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Air Compressors
OF BELLISS MAKE
have gained their reputation for

- Simplicity of Design
- Noiseless Running
- Compact Design
- Low Oil Consumption
- Continuous Operation
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Messrs. Belliss & Morcom, Ltd.
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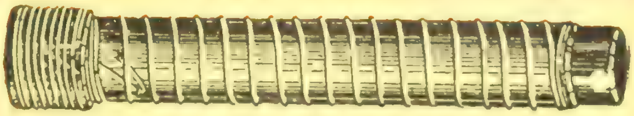

Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One half the cost of Iron Pipe and better.

Pacific Coast Pipe Co., Limited
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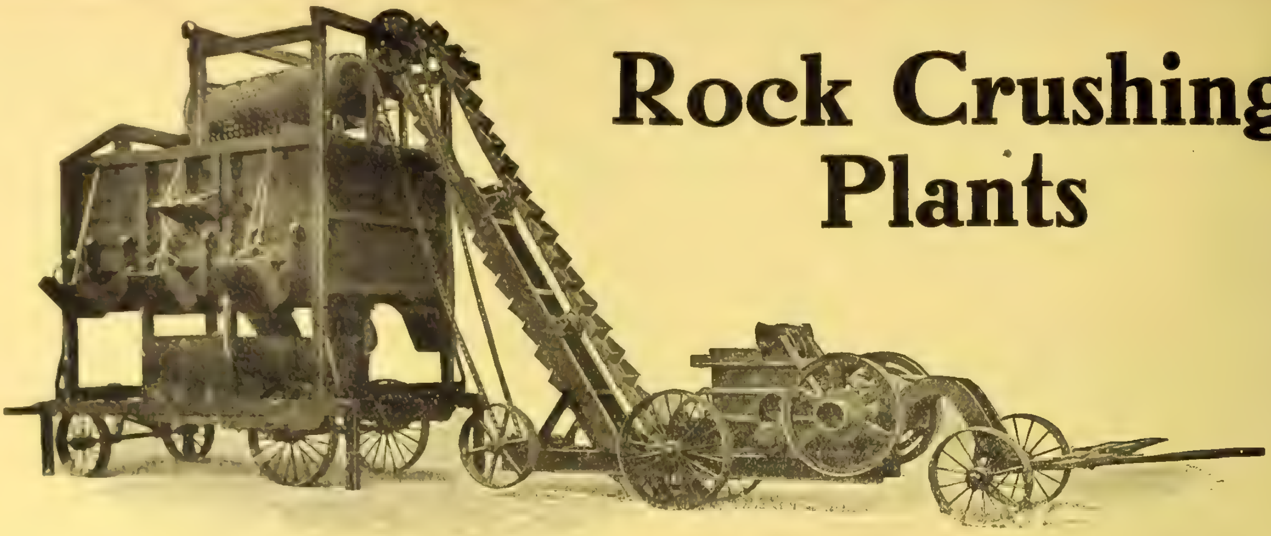
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6



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Complete, Self-contained, Portable, Crushing, Grading and Loading Plant

The adaptability of the above plant, the ease with which it can "follow the job" makes it an ideal outfit for the Contractor. It is only one of our many combination machines for crusher work.

Full details of the various parts will be gladly furnished by any of our offices.

THE JENCKES MACHINE COMPANY, LIMITED

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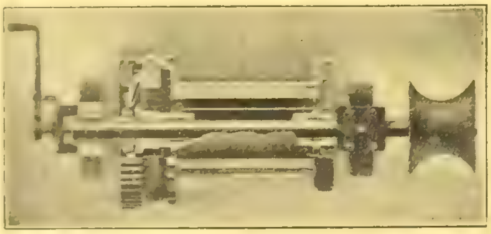
If You Had to Run It Yourself Which Engine Would You Choose?



Suppose you were engineer of a hoisting engine, operating a clamshell bucket or running a derrick that required fast, continuous work, which would you prefer—an engine with an easy operating friction; easy to throw in, easy to hold in, or one with a friction that required violent effort to throw it in and equally violent effort to hold it there? That's the difference between

"AMERICAN" EXPANSIVE TYPE FRICTIONS

and the cone type universally sold with other engines—a type in which it is necessary to push the whole drum across the shaft and hold it there by main strength. The strength and weight of the operator and the push of the thrust screw have to do the whole job.

"AMERICAN" Friction supplements the push of the thrust screw with the toggle action of the friction; this produces a thrust several times greater than the unassisted push of the thrust screw.

An untired operator is bound to get better results than one fagged out by needless tussling with a cumbersome machine.

The cool running "AMERICAN" friction; quick, positive, easy to operate, will save you money. Make us prove it.

—MADE BY—

AMERICAN HOIST & DERRICK CO

ST. PAUL, MINN.

SOLD BY—

General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Gorman, Clancey & Grindley, Edmonton, Alta., and Nelson, B.C.

Stuart Machinery Co., Limited, Winnipeg, Man.
Vancouver Machinery Depot, Limited, Vancouver, B.C.

Hydraulic Lift Lock, Peterborough, Ont. Monolithic Concrete Construction containing 26,000 cubic yards. Height of Lift 65 feet. Weight of water in each tank 1,300 tons.

Concrete's Stability and Strength

In the building of any structure to withstand the strain of a live load such as will be imposed on the Peterboro Lift Lock, the factors of the stability, strength and economy in any material must necessarily be considered first in importance.

Any substructure with sufficient strength to sustain so great a live load must be built in a unit to give the required stability, and there is no doubt that concrete is the best material that could have been adopted for this purpose. It's use

Means Economy

by reason of the greater portion of the material and labor being obtainable in the district in which a concrete structure is built. This facilitates construction, means convenience to the contractor, and returns most of the cost to the people of the district.

Let us send you fullest information about concrete structures for every purpose, without cost or obligation.

Information Department

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All Sizes and Styles

Steam, Electric and Belt Driven.

Standard Sizes Carried in Stock.

Special Outfits Designed

A Full Line of
Contractors' Supplies

Catalogue Sent on Request.

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QUEBEC, 31 St. Louis St.
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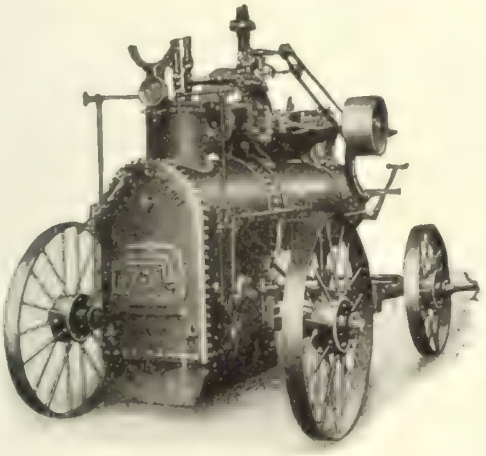
HALIFAX, 78 Granville St.

Power That's Dependable

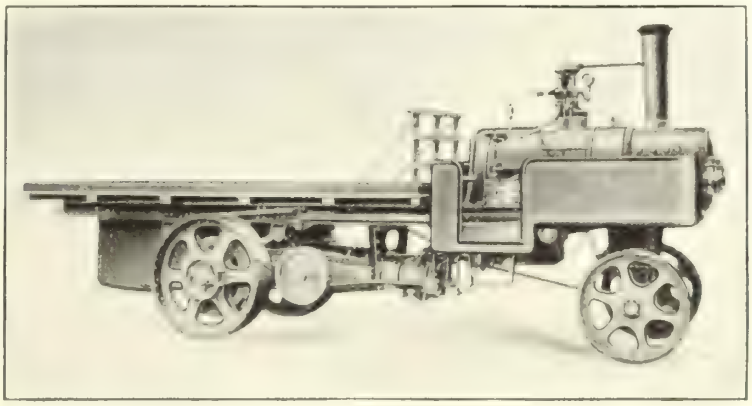


The **FARQUHAR** Ajax Center Crank Engine on locomotive boiler on wheels, illustrated herewith, is ideal for furnishing power for Crushing, Sawing, Threshing, etc.

It contains all the special features of the Farquhar manufacture which insure extra long life and entire satisfaction.

Mann Steam Wagons

Made in 3, 5 and 7 ton sizes
will do your hauling
most economically.



See our exhibit of Road Making Machinery at the Montreal Good Roads Congress May 18th to 23rd.

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(Continued on page [illegible])

Built for C.P.R. Montreal

Canadian Plant

Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

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KOEHRING CONCRETE MIXERS

When the Koehring Mixer is equipped with this type of loader, the Mixer can be placed at any elevation above the ground and still the bucket can be filled on the ground.

An advantage of this extension loader which differs from others, is the feature that the track can be placed at various angles from the machine without making any change in the connections.

The Koehring Mixer with Extension Loader

Showing Loader in Elevated Position

CANADIAN ALLIS-CHALMERS
LIMITED

Manufacturers of Air Compressors, Avery Scales, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Lidgerwood Engines and Cableways, Locomotives, Logging Machinery, Mining and Crushing Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Shovels **Steam Turbines, Turbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water Wheels, Water Pipe.**

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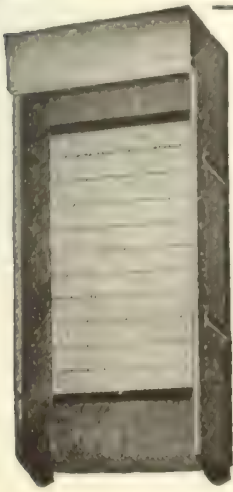

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SAND and GRAVEL SCREENS

We make SCREENS for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
Hamilton

WELLS AND GRAY, LIMITED

Engineers and Contractors

Buildings and Construction Work
OF ALL KINDS

Reinforced Concrete a Specialty

Write us for preliminary plans, estimates and photos of our work.

247 Confederation Life Building, TORONTO, ONT.

Trinidad Liquid Asphalt

One of 3000 Miles

of good roads in the United States and Canada surfaced with Trinidad Liquid Asphalt.

Results obtained with this material are **permanently** good because Trinidad Liquid Asphalt has the stability of the **Lake** Asphalt, with which it is closely related.

It does not "bleed" and disappear in the form of greasy dust. It stays in the road and builds up a lasting asphaltic surface.

The defects of oiled roads are mainly due to paraffin—a grease—Trinidad Liquid Asphalt contains no paraffin. Applied hot or cold, it is a permanent constructive agent —not a temporary dust layer.

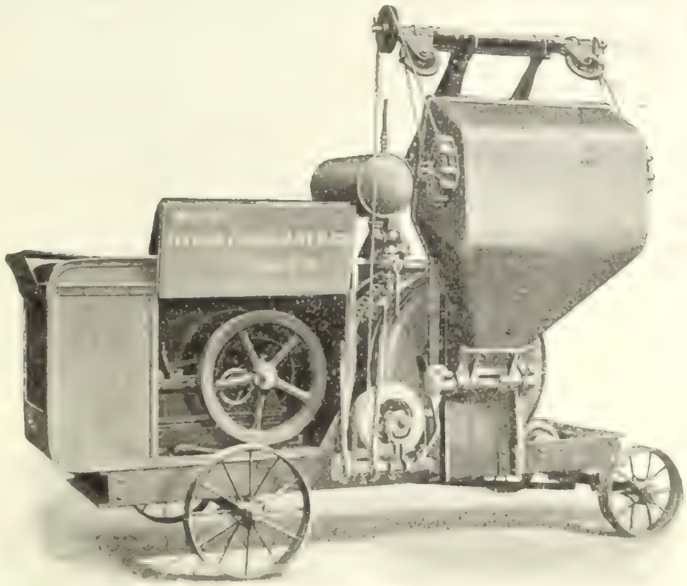
Trinidad Liquid Asphalt booklets are interesting to engineers, contractors and tax-payers. Ask also for new illustrated booklet, "The Wonderland of Trinidad."

The Barber Asphalt Paving Co.

Philadelphia, Pa.

ANNOUNCEMENT

Most Mixing



Least Fixing

It is with much satisfaction that we announce to the contractors and builders of Canada our recent connection with the Marsh-Capron Mfg. Co., of Chicago. Knowing full well the heavy demands placed upon a concrete mixer in Canada we spared no effort to determine which, in our estimation, was the best mixer built. As a result of this investigation we are proud to offer

THE M-C RAIL TRACK MIXER

Equipped with Fairbanks-Morse Gasoline Engines

There are several hundred of these mixers in successful operation in Canada— there were five used on the big C. P. R. irrigation job at Bassano, Alberta. We carry a complete stock of all sizes and equipment at our several warehouses and are always in a position to make immediate shipments quick.

Write our nearest branch

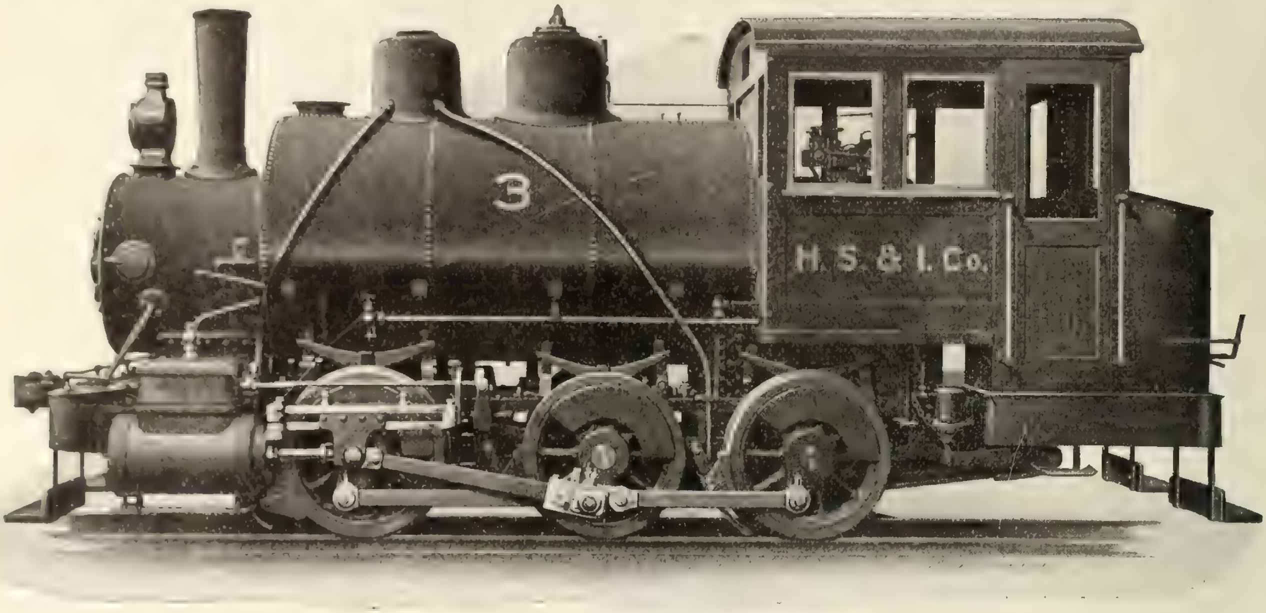
CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engines built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names in Mind when Ordering High Grade Brick.

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Pearl Clay Products Co.
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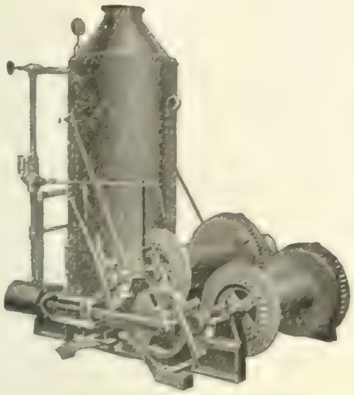
BLACK BUILDING SUPPLY CO., LTD. - TORONTO



Standard Hoisting Engine

The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

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Montreal, P. Q.—Foss & Hill Machinery Co.
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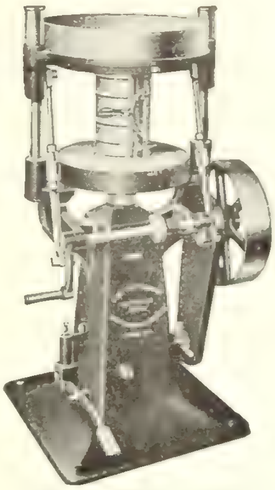
Quebec, Que.—A. D. Masson.
Ottawa—The General Supply Co., of Canada.



Dunn Cement Drain Tile Machine

the Largest Manufacturers of Concrete Machinery in Canada

Concrete Mixers

—

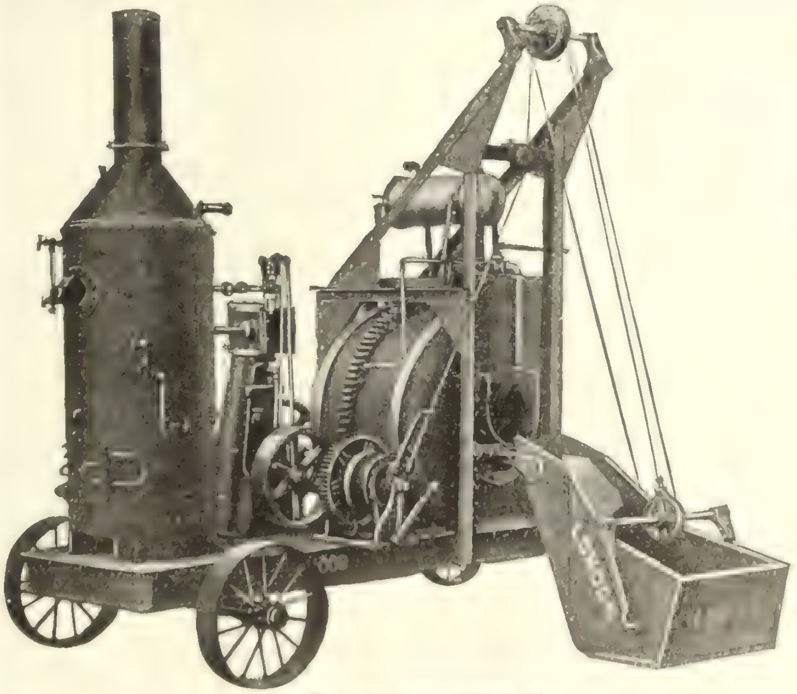
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

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—

Pumping Outfits

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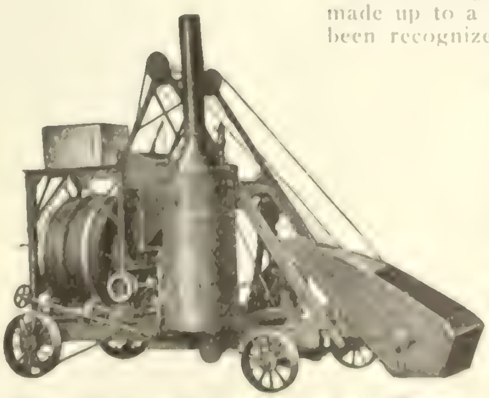
Hoists and Derricks

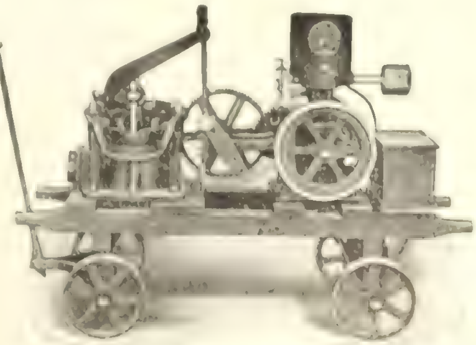
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of [illegible] [illegible] and contractors' equipment.

Correspondence Solicited.



Rear Discharge Paving Machine with Forward Loader



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- Thorold Co., F. W.
- Tyrrell, H. G.

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- Original Gas Engine Co.
- Wettlaufer Bros.

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- Hobbs Mfg. Co.
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- Escher Wyss & Co.
- Mannesmann Tube Company.
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- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
- Morris Hoist & Crane Co., Herbert.
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- Royce Limited
- Sturtevant Co. of Can. Ltd., B. F

(Continued on Page 14)

BRUCE PEEBLES

Alternators and Generators

are built suitable for belt-drive or for direct coupling to any form of prime mover.

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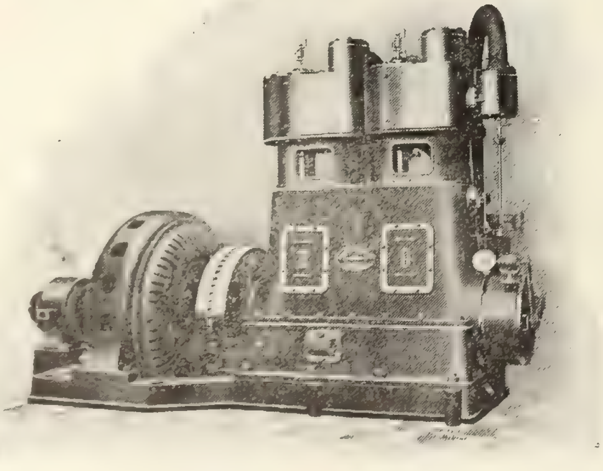


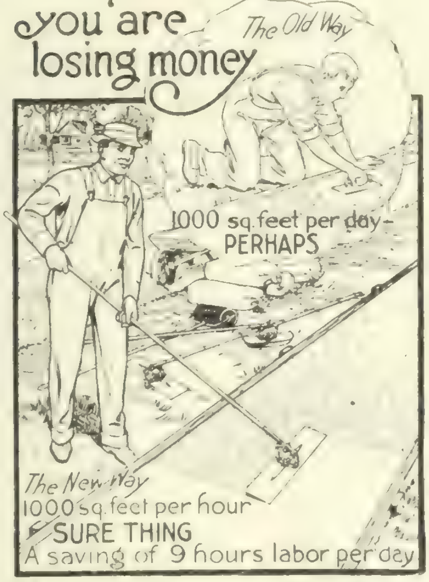
Peebles-Browett Alternator Set

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money



Abram Cement Tool Co.,
Windsor, Ontario

WESTERN

Dump Cars Elevating Graders
Dump Wagons Wheeled Scrapers

HAVE NO EQUAL

Since the Western Wheeled Scraper Company began business in 1877, it has been our policy right along to make the very best goods possible, regardless of cost. Therefore while the first cost of Western products may in some cases be more than that of other makes, yet in the end they prove the cheapest because they are rapid and economical.

The Western line of earth and stone handling machinery is always to the front where work is to be done quickly and satisfactorily.

Write for Booklet

WESTERN WHEELED SCRAPER CO.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta
Can. Equipment Co., Montreal—Agents for Eastern Canada.

Macadam Roads

must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Canadian Sirocco Co.
Sheldons Limited

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Northern Crane Works.

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Wettlaufer Bros.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

Ice-making Machinery
Linde British Refrigeration Co.

Insulating Compounds
Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
Batts Limited
Canada Office & School Fur. Co.
Rhodes Curry & Co.

Jib Cranes (all kinds)
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

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Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
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Jamieson Lime Co.
Ontario Lime Co., Ltd.
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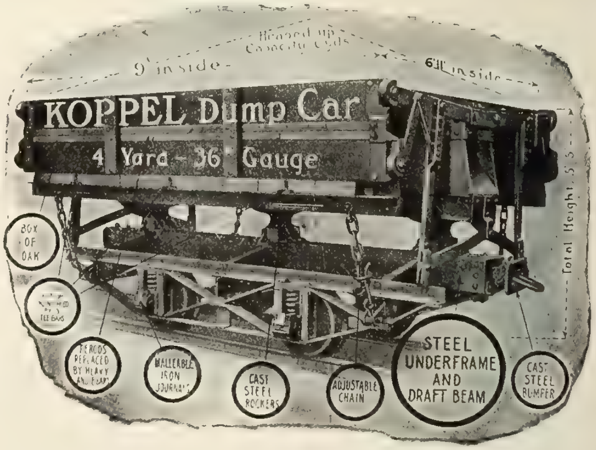
What Big Contractors
Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein - Arthur Koppel Co.

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Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

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NOTE THE PERPENDICULAR POSITION OF THE

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See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

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First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

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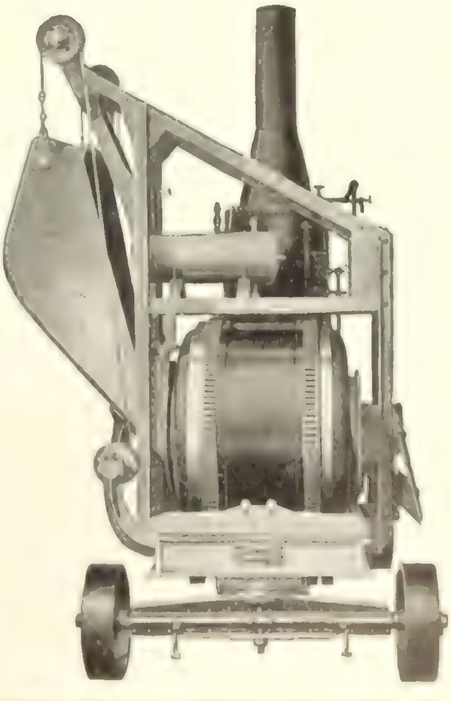

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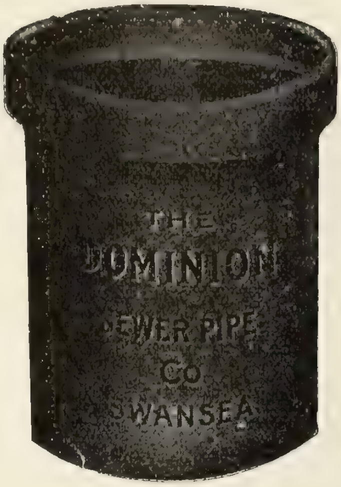

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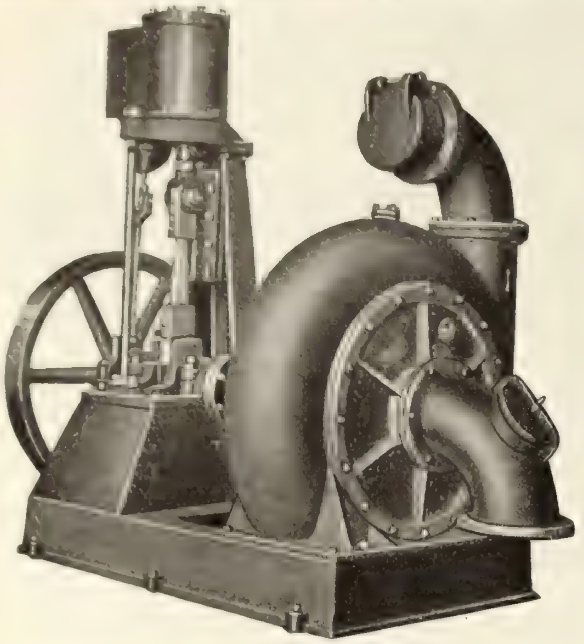
ROUND PIPE AND SQUARE DEALINGS

The Ontario Sewer Pipe Company, Limited

MIMICO, - ONT.



Contractors Sand and Dredging Pumps
Complete Hydraulic Dredging Machinery
Centrifugal and Turbine Pumps for Every Service

MORRIS MACHINE WORKS - Baldwinsville, N.Y.
Canadian Sales Agents—
Storey Pump and Equipment Co., Ltd., Toronto, Montreal

OUR CRUSHED
STONE
For Concrete or Roadwork is unequalled
PORTLAND
CEMENT
TRAP ROCK GRANITE
All Sizes for
Floors, Curbs and Sidewalks
Prompt Delivery Service
BY
C. P. R., G. T. R. or Our Own Teams

Rogers Supply Company, Limited
28 King St. West
Toronto
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"Keith Fans"

A great advantage will be gained to consult us when considering the installation of a Heating and Ventilating System.

Our ***"Keith Fan"*** has come to the front in the Heating and Ventilating World and is considered by experts to be the most practical and economical Fan yet produced.

It will pay you to investigate ***"Keith Fans."***

SHELDONS LIMITED - - GALT, ONTARIO
TORONTO OFFICE, - - - **609 KENT BUILDING**

AGENTS:
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KAHN SYSTEM

OF REINFORCED CONCRETE

Steel Sash

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STEEL FLORETYLE

FOR LONG SPAN CONSTRUCTION

Trussed Concrete Steel Co.
of Canada Limited
Head Offices and Works: Walkerville, Ont.
Branches Everywhere

Elevated

Steel Tanks

Hemispherical and Segmental Bottoms

Manufactured at Pittsburgh, Pa.

Erected Anywhere

We have special designs for Municipal, Railway and Industrial service.

Catalogue No. 15 sent upon request.

Pittsburgh-Des Moines Steel Co.

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Des Moines Bridge and Iron Co.

Des Moines, Iowa	938 Tuttle Street
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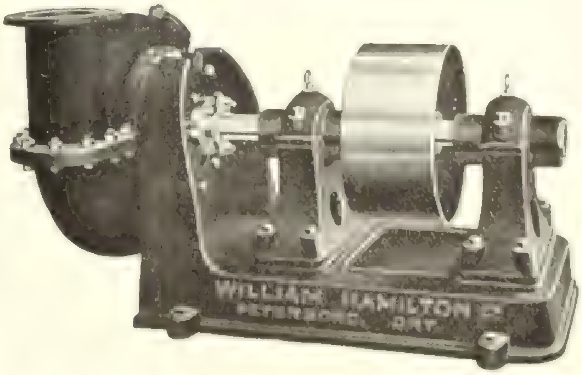
Office of Dominion Iron & Steel Co., Ltd
Built of Sydney Pressed Brick

IN this product you get a brick of such superior quality that a saving of one dollar a thousand can be effected in the laying of the bricks as compared with ordinary irregular brick.

The mortar adheres with great strength to "Sydney" pressed brick and they harden with age.

Prices and Particulars on request.

Sydney Pressed Brick Co.
Limited
Sydney, Nova Scotia



Contractors' Pumps

These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

William Hamilton Company
Peterborough, Ontario

J.O.B. CONTRACTORS PUMPS

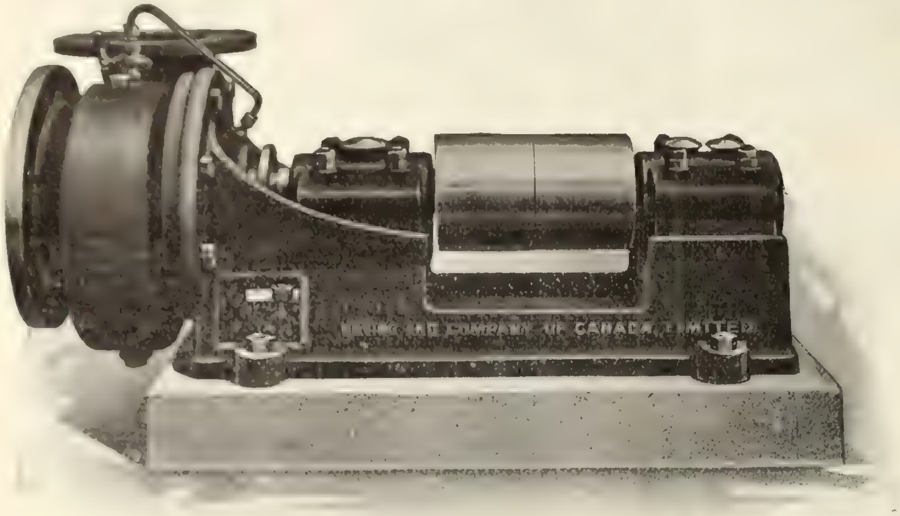


Illustration shows 10" Contractors Pump.

Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

Let Us Quote on Your Requirements

Pumps for all purposes
Belt Driven
Direct Connected
High, Medium and
Low Pressure

Boving & Co. of Canada Limited

Head Office: 164 Bay St., TORONTO
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"Big-an-Little" MIXERS

Here is the ideal mixer from every point of view. It gives a thorough mix. The material is always on view during mixing. The operation and up-keep costs are surprisingly low. As for speed, "A Mix a Minute" is our regular output. Loading and unloading are the simplest of operations.

For simplicity, durability, strength and low price to you the Big-An-Little-Mixer is a marvel.

We want Canadian Agents

Write for our Catalogue, etc.

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The Mark of Quality

Apollo Keystone

Copper Bearing Steel Galvanized Sheets

AMERICAN SHEET & TIN PLATE CO.
APOLLO
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TRADE MARK REGISTERED
KEYSTONE

UNITED STATES STEEL PRODUCTS COMPANY

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Sewers and Culverts

properly built of properly made

Reinforced Concrete Pipe

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

Dominion Concrete Company Ltd.

Kemptville, Ontario

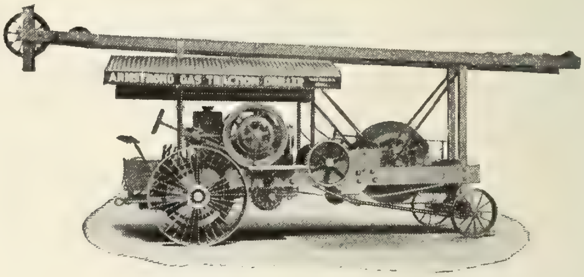
DANGER!

There are "BREAKERS AHEAD" for the Quarry Operator Who Does Not

STOP! and consider—that the most economical method of drilling blast holes is with an Armstrong Special Blast Hole Drill—that the same efficiency should be demanded from the drilling machines as from any of the quarry equipment—that the method of drilling employed frequently represents the division between profit and loss—that in adopting this system of drilling, the labor problem is reduced to a **minimum** and that the **"Armstrong" is the only special blast hole drill designed for rock drilling exclusively.**

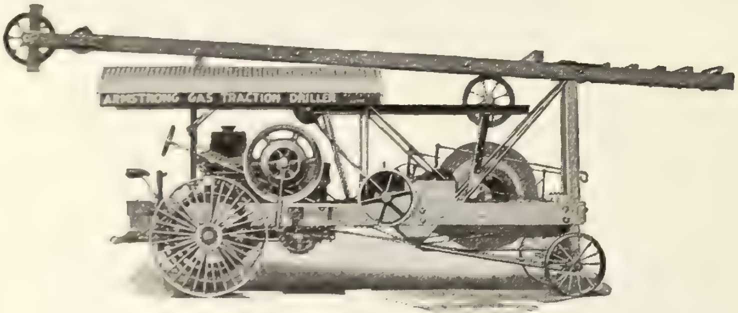
LOOK! at these two machines illustrated on this page. One is a Well Drill, the other a Special Blast Hole Drill. Little difference in the general design with the exception of the Spudding Beam; but note this difference carefully. That one feature determines the results you can expect from your tools in a drilling motion—is the one point that increases your efficiency from 50% to 100%, and is the reason why the **Armstrong Special Blast Hole Drill** will drill more blast holes, at less cost, and with less wear and tear than any other machine made.

Armstrong Water Well Drill



LISTEN! to reasons:—We illustrate our Water Well and Blast Hole Drills so **you** can see the difference—so that **you** will know that the drill we call our Special Blast Hole Drill is not a Water Well Drill, and so that you may "ask to be shown" by any manufacturer of cable drills the difference in the design of their blast hole and water well drilling equipment.

Armstrong Special Blast Hole Drill



Write today for detailed information.

ARMSTRONG MANUFACTURING CO.

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Canadian Branch
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Homestead Avenue, Mt. Vernon, N. Y.—Aztec Road Binder Penetration Method

AZTEC ASPHALT

For Every Road

For macadam, dirt and gravel roads, Aztec Liquid Asphalt provides the best and most efficient surface treatment. It is a pure, natural maltha possessing the necessary constituents to cause it to penetrate thoroughly the surface of a roadway. Upon evaporation there is left a hard asphaltic binder, which gives the road the appearance of a sheet asphalt pavement.

The great demand for Aztec Liquid Asphalt last season is the result of the experience and recommendation of those who have previously used it.

Aztec Asphalt for city pavements is the best known material for this purpose.

COMMERCIAL USES

Astec is supplied with the consistency best suited to the special purpose for which it is required. Prompt deliveries on asphalt for

ROOFING
WATERPROOFING
INSULATING
BLOCK FILLER
PIPE DIP
RUBBER MAKING

For sheet asphalt or for road binder—either mixed or penetration method—Aztec excels.

We also sell Aztec Fuel Oil and Gas Oil.

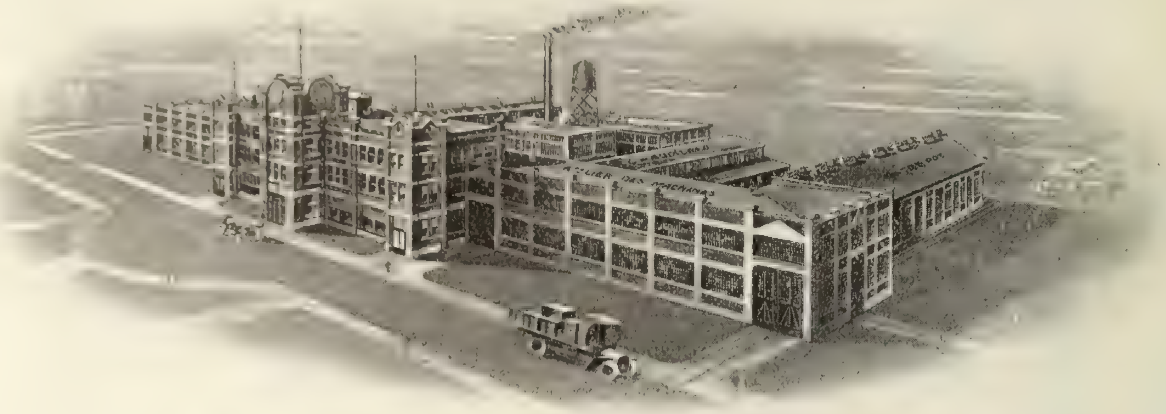
Write us for literature.

Aztec Oil & Asphalt Refining Co., of Canada

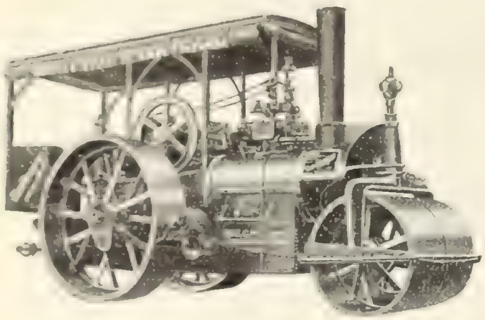
137 McGill Street, Montreal

General Car and Machinery Works, Limited

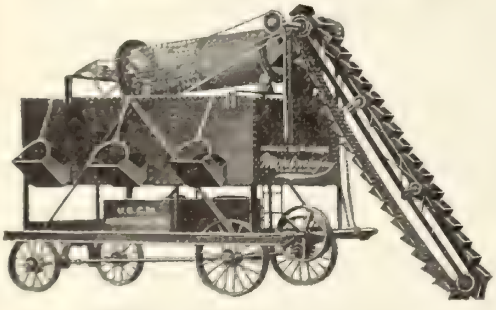
Quebec MONTMAGNY, P.Q., Can. Montreal



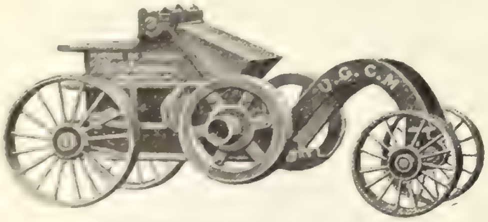
Head Office and Works



"Montmagny" Steam Road Roller.



"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny"

Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

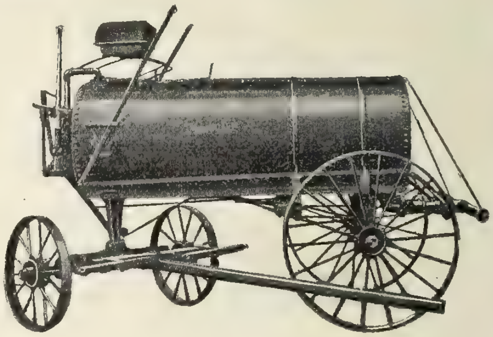
Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

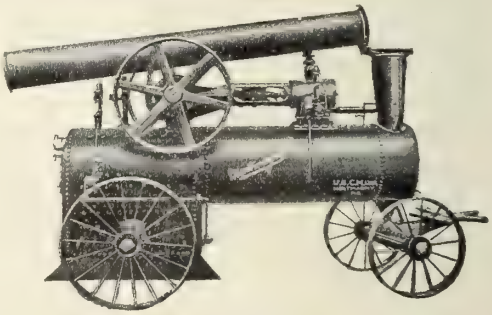
The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

For crushing field stone, granite, etc., "Montmagny" jaws are made of **manganese steel.** They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.



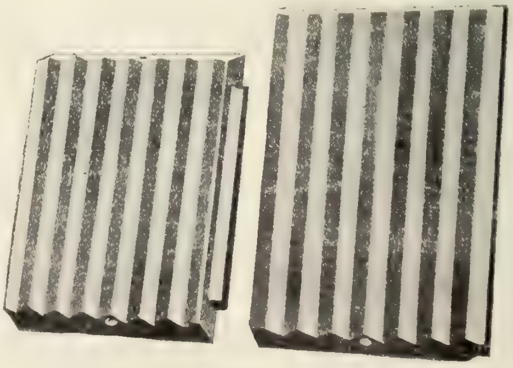
"Montmagny" Road Sprinkler.

The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.

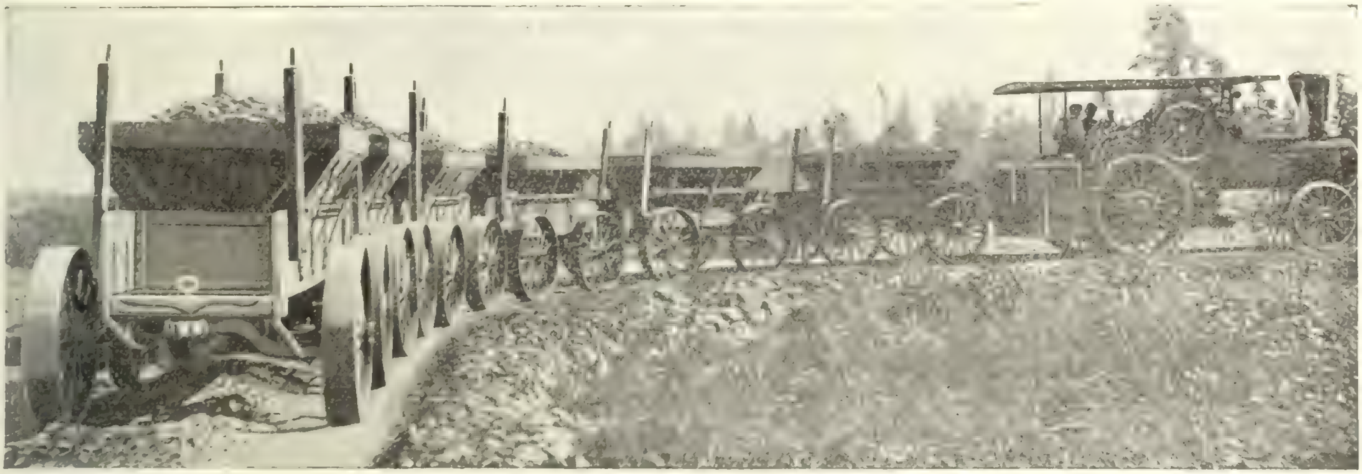


"Montmagny" Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.



"Montmagny" Manganese Steel Jaw Plates.



Six TROYS making a right-angled turn on a nine-foot road—a bit of evidence from Port Arthur, Canada.

Note that the last wagon tracks exactly with the engine.

"If weather conditions would permit a haul of 60 days continuous work, we would have

Enough Profit in our Jobs to Pay for Twice as many Troy Reversibles"

J. R. Sutherlin & Co. of Kansas City, Mo., are probably doing more construction work than any one firm in their section of the country. Here's what they have to say about Troy Reversibles—Doesn't it sound pretty good to you?

"With reference to the Reversible wagons, will state we are using 19 of them and they are making us money. It is true the weather conditions have delayed us to some extent this fall but that would have been the case in using any other kind of wagon. We are hauling with an 80 horse power steam engine and pull from 7 to 8 three yard wagons to a trip at a nominal cost. If weather conditions would permit a haul of 60 days' continuous work we would have enough profit to pay for twice as many Troy wagons as we own."

Troy Reversibles will make money for you, too. If you do big hauling, stop and consider for a moment what a 50 to 80 per cent cut in your hauling cost would do to your profits. Make us prove up. Just ask for Hauling Book 2 R.

The Troy Wagon Works Co.

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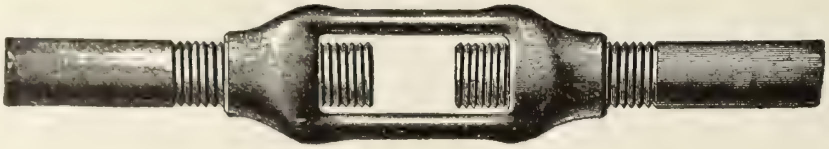
Canadian Billings & Spencer, Limited

B
TRADE MARK



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Full line of steel specialties for
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Welland, Ontario

Burlington Steel Co.

(Formerly Canada Steel Co., Ltd.) Limited

Hamilton - - Canada

STEEL BARS

for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares,
Angles, Channels, T-Bars, Ovals, Half Ovals,
Half Rounds, Bands, Special Sections.

CROSS ARM BRACES — POLE SHIMS
Plain and Galvanized

Prompt Shipment from Stock

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Road Graders, Rock
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Engines, Steam Road
Rollers, Sprinklers
etc.

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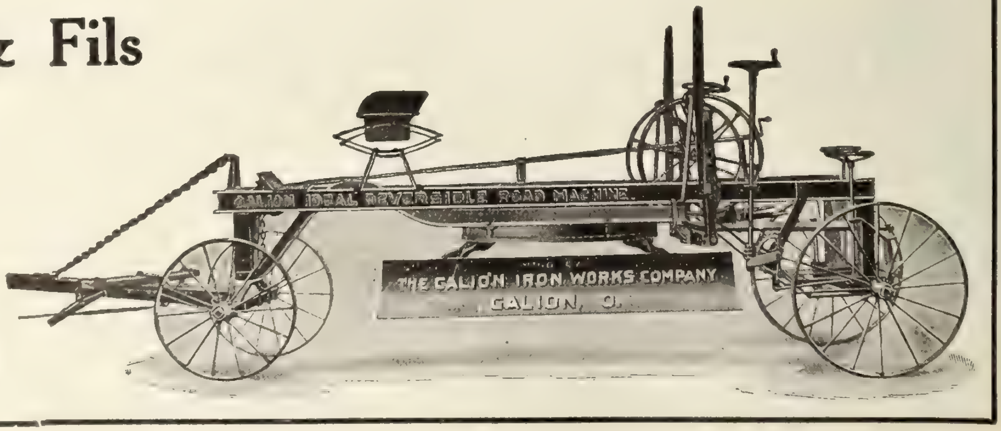
and Laprarie, Que.


GALION IDEAL REVERSIBLE ROAD MACHINE
THE GALION IRON WORKS COMPANY
GALION, O.

For Permanent Lines:

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30″ Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

General Offices: BURLINGTON, NEW JERSEY

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2 4/10c. per Cubic Yard

excavating in hard clay and boulders with a Number O steam driven

AUSTIN TRENCHING MACHINE

Look at the boulders that we handled

in use in Canada. The letter quoting this Austin operating-cost record was received from our Canadian Agents only the other day.

You want a trenching machine of such RECORDS, because by this you can be certain that there is the proper construction to make such records possible on YOUR work.

Write to our Canadian Representatives:

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F. C. Austin Drainage Excavator Company

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Residence of Ralph Peters, Esq., President, Long Island R.R.
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Siding stained with Cabot's Shingle Stains, stucco stained with Cabot's Waterproof Cement Stains, and lined with Cabot's Quilt, for warmth.

CABOT'S CREOSOTE SHINGLE STAINS

The Standard Stains for Shingles, Siding or Trimmings. The first shingle stain ever made, and quality guaranteed by thirty years' use. Made of the strongest and finest colors, ground in pure linseed oil, and Creosote, "the best wood preservative known," No cheapeners, no adulterations, no kerosene or benzine.

CABOT'S "QUILT"

The warmest lining. Heat-proof. Cold-proof. Sound-proof. Uninflammable, non-decaying, vermin-proof. Insulates cold-storage and ice-houses, and all other buildings. Deadens sound in floors and partitions.

Cabot's Waterproof Cement and Brick Stains

For waterproofing and tinting stucco and similar cement surfaces, and for freshening, restoring and waterproofing bricks.

For preserving ties, poles, planking and all other lumber.

Cabot's Plasterbond Damp-proofing

For direct plastering on brick or concrete without studding or lathing. Forms a perfect permanent and impervious bond.

Cabot's Conservo Wood Preservative

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Strongest, finest and most lasting.
Send for Samples and Prices.

SAMUEL CABOT, Inc., Mfg. Chemists, Boston, Mass

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What this Bolt will do

It fastens heavy fixtures, electrical and otherwise, with a vice-like grip to hard surfaced walls, floors and ceilings so they cannot break loose nor wabble, as they are sure to do sooner or later by the wood plugging or leading-in method. The fixture sets neatly and tightly to the wall and cannot be pulled down.

SEBCO

The most dependable fastener known for fixtures, push buttons, lamp brackets, telephones, chandeliers, heaters, motors, etc.

Write for Catalogue and Samples, and you will never use any other.

STAR EXPANSION BOLT CO.

147-149 Cedar St., - - New York

'TIS AIR THAT CLEANS

HOUSE INSTALLATION

Spring House-cleaning is a Thing of the Past in a Building or Home Equipped with a Tuec.

Tuec Stationary Air Cleaning System

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THE ALL-STEEL

Self-Rotated, Self-Lubricated

JACKHAMER

A User Says:

Dear Sirs:—

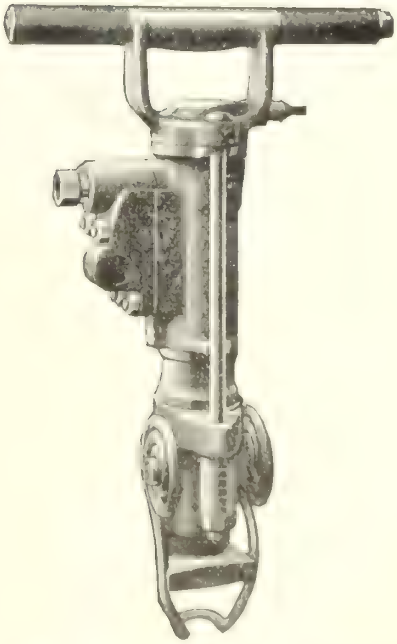
When my first Jackhamer arrived, it looked so small and light, I was afraid it would not stand up to the work it receives in a quarry. Since then, however, I have changed my mind. We have worked the drill steadily all season, from 8 o'clock in the morning until 5.30 at night. In fact it is running all the time. The men like it because it is light and easy to handle, and any place a man can get a foothold, he can put in a hole with this little drill. Had we not had the drill last season, we would have been held up for stone more than once, and as it is we were not delayed, nor was the drill off the job one day for repairs.

We drill our holes to a depth of 6 ft. without a bit of trouble and can safely say our average drilling is about 5-in. per minute. It is indeed a wonder and we would not be without it at any cost.

Yours truly,

HUGH LOGAN,

Georgetown, Ont.



The Jackhamer weighs 40 lbs. and is 18 ins. long.

OPERATED BY STEAM OR AIR

CANADIAN INGERSOLL-RAND CO., LIMITED.

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Works: SHERBROOKE, QUE.

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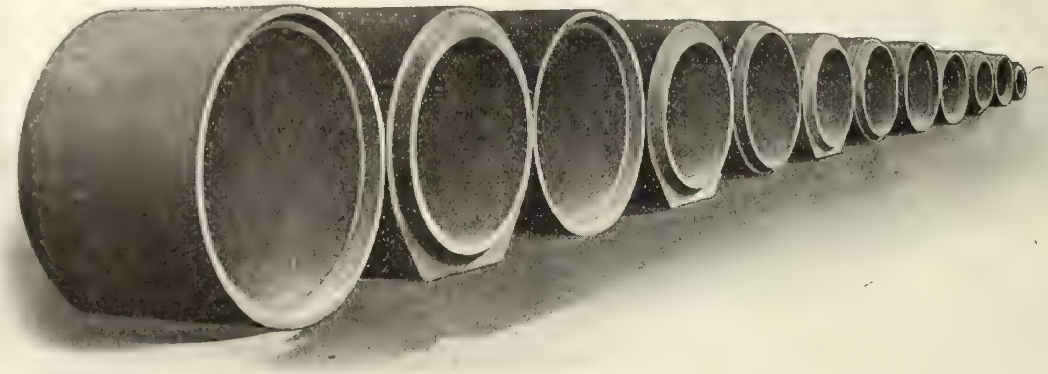
The Age of Concrete

Architects and contractors throughout Canada now fully realize the wide possibilities of concrete for building purposes. We are running the most modern plant in Ontario, and make a point of meeting orders calling for special ornamental trimmings for public buildings, churches and schools. Our concrete manufactures comprise a full line of pipes and building materials, steam-cured by the latest scientific process. We can quote you on all concrete products.

Heavy reinforced concrete railroad pipe and cement drain tile our specialty.



National Concrete Mfg. Company, Limited
LINDSAY, ONTARIO

THE HOPE CANADIAN FACTORY

HOPE STEEL SASH

Embodies points of merit that make it worthy of your consideration. Scientifically designed and economically constructed it recommends itself to discriminating architects and engineers.

HOPE SASH has demonstrated its superiority in thousands of buildings in Canada and the United States as well as other parts of the world. It is a sash with a reputation for excellence back of it.

HENRY HOPE & SONS OF CANADA, LIMITED
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IT WITHSTOOD THE SMOKE-TEST

Our illustration shows a section of

Pedlar's TONCAN METAL Corrugated Culvert Pipe

recently installed by the Town of Oshawa, Ont., as a storm sewer.

The joints were coupled with Pedlar's regular Coupling Bands, and were so close and tight that they withstood perfectly a severe "Smoke-Test."

Pedlar's Rivetted Culverts and ***Pedlar's Nestable Culverts***—the latter being very handy to transport—are very flexible and easy to install, and will not crack or break from freezing.

Skilled labor is not necessary. ***Pedlar's Culverts*** have a large variety of uses, and can be employed with advantage in nearly every case where a pipe of any kind is necessary.

Made of Highest Grade Heavy Gauge Anti-Corrosive TONCAN METAL **Write for Culvert Catalogue, No. 4 C.R.**

The Pedlar People, Limited. **Head Office and Works:** **Oshawa, Ont.**

ESTABLISHED 1861

Branches: ***Montreal, Toronto, Winnipeg, London, Chatham, Ottawa, Quebec, St. John, Sydney, Halifax, Calgary, Vancouver.***

Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

TRADE MARK

Announce the opening of their new plant, equipped with the most modern and up-to-date machinery for the manufacture of

"ADAMANTINE," CHROME AND MANGANESE STEEL CASTINGS

(Annealed and Unannealed)

Cement Mill Machinery

Our Specialty

Tube Mill Feeders
Griffin Mill Roll Heads
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Lining Plates for Bonnot Tube Mills
Parts for Bonnot Pulverizers
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Eccentric Hubs, Crusher Heads and Concavo Strips for Gates Crushers
T. M. Revolving Feeders (new style) for Gates Tube Mills

PATTERNS FOR ALL THESE LINES KEPT ON HAND.

Machine-Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass Bronze and Aluminum Castings.

We solicit your patronage and prompt attention will be given to tenders on above work.

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Standard White Lime Co.
GUELPH, ONT.

manufacturers of high calcium and magnesia lime.

Works at Guelph, Brockville and St. Marys.

We make a specialty of

Hydrated Lime

You always have fresh lime when you use Hydrate.

Head Office - GUELPH

Write us for further information

WELLER-MADE

Whatever your Elevating, Conveying or Transmission problems are the Weller Machinery will solve them correctly, quickly and inexpensively.
This fact aided by the Weller Engineering Department, whose services in prescribing for specific conditions can best appreciated when *experienced.*
Write for our No. 26 catalog describing Weller Machinery in full.

DUMP CAR

WELLER MFG. COMPANY, CHICAGO

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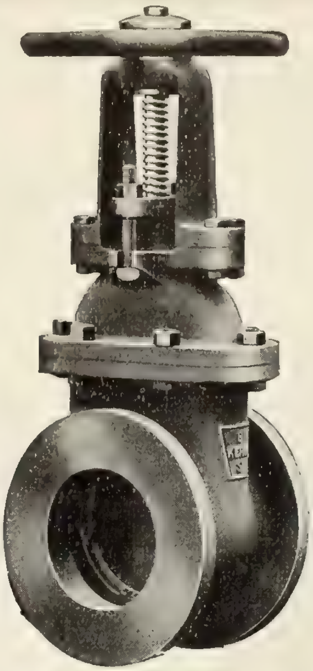

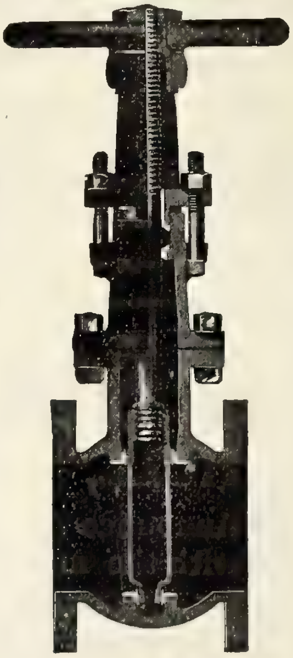

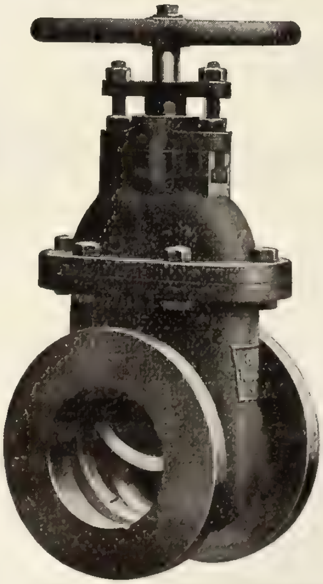

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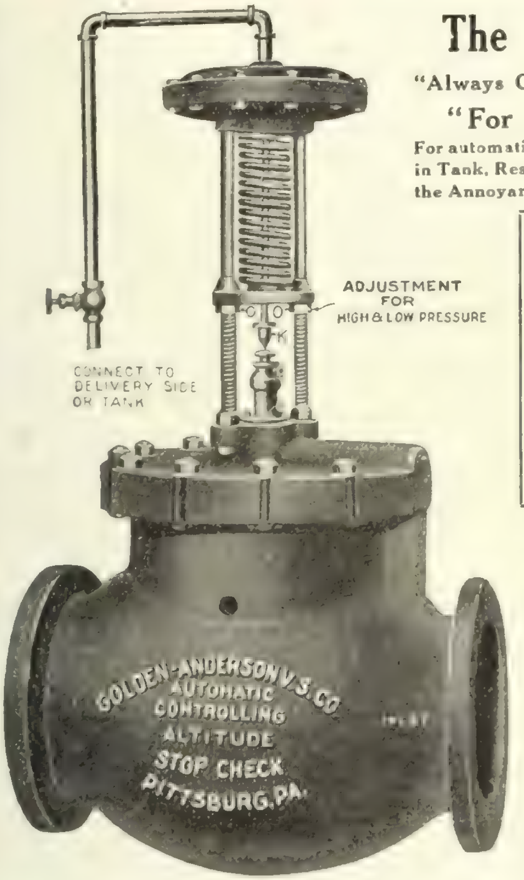

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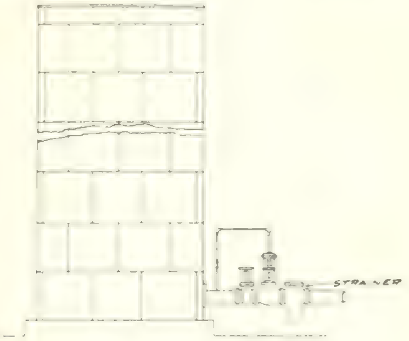

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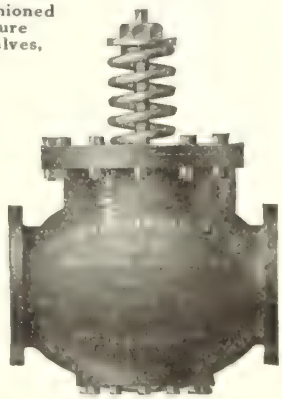

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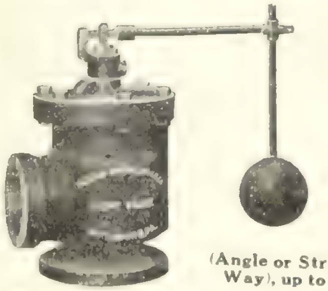

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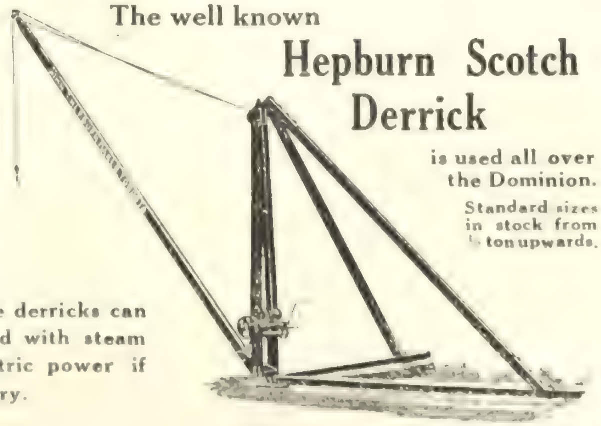

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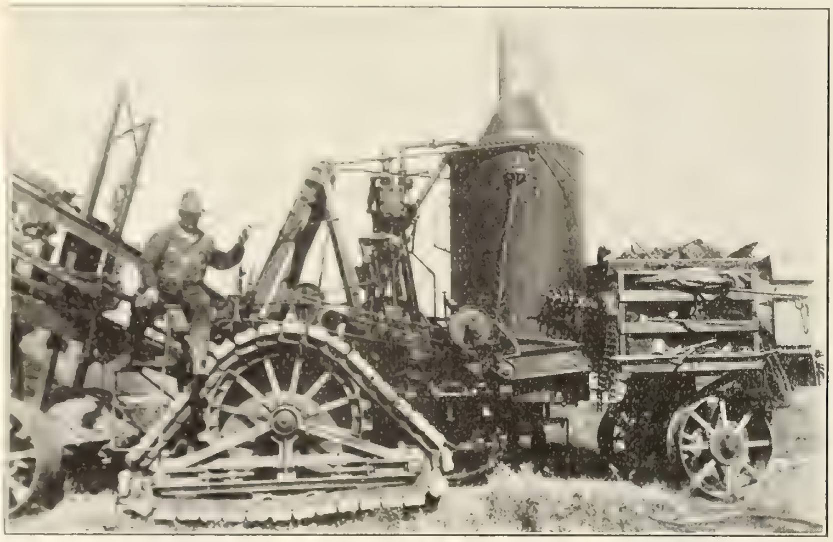

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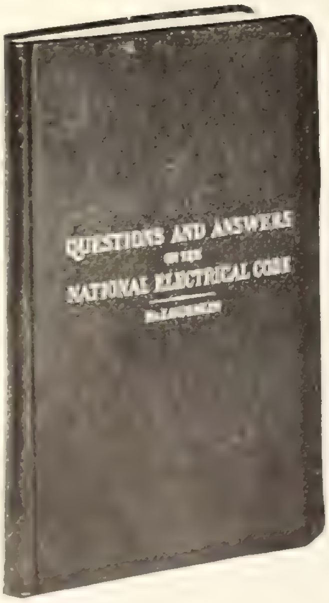

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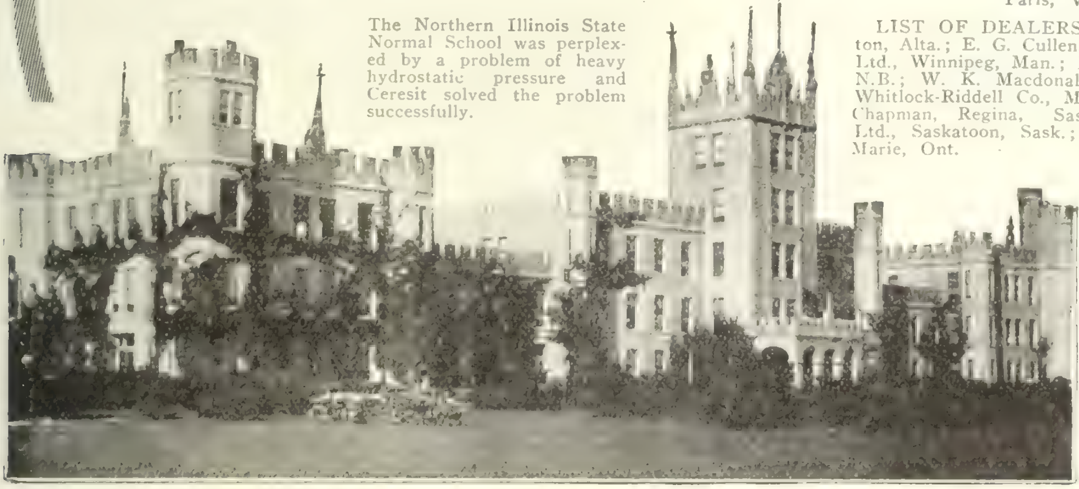

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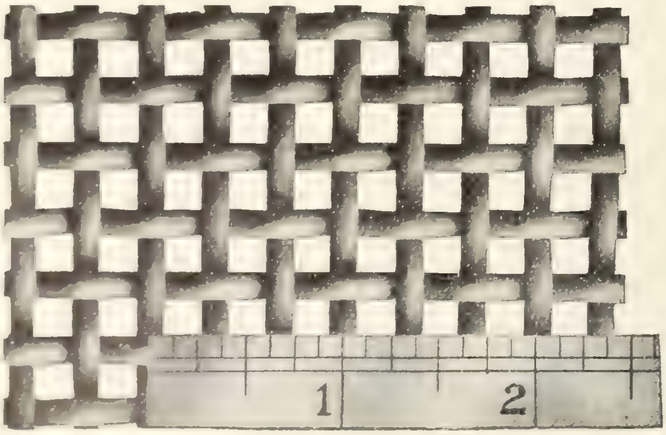

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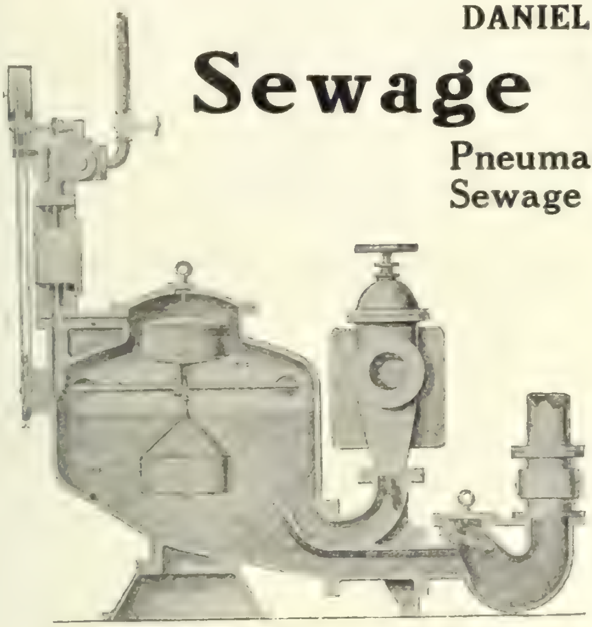

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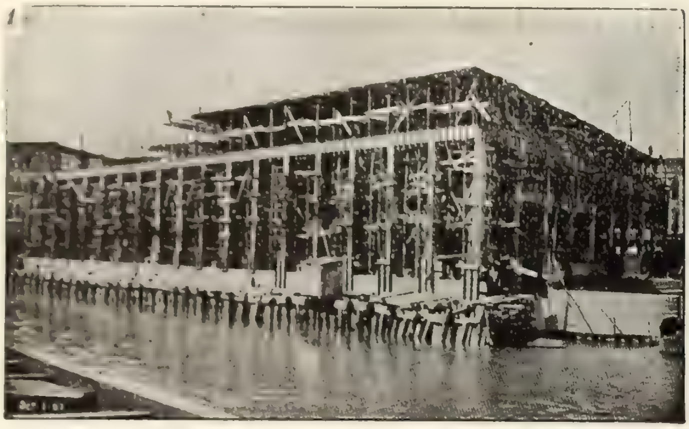

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SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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Workmen's Compensation in Ontario

EMPLOYERS of labor in general, and contractors in particular, throughout Ontario may well view with apprehension the Compensation Act which the province is about to put through, and **should oppose it tooth and nail.** Objections to the bill may be said to be legion, but one of the most serious is that under certain circumstances the employee is enabled, without regard to negligence on his part, to obtain compensation to the extent of 55 per cent. of his former earnings, the payments to be continued, if necessary, for life and in the event of death to continue to the widow or other dependents.

Of all spheres of activity, contracting and allied work are perhaps the most susceptible to accidents, and in spite of the "Safety First" movement and the extra precautions for which it has been responsible of late, the dangers attendant upon the execution of large building and engineering works have not been lessened—due perhaps to the increased magnitude of such enterprises and the growing demand for speed in construction. This the employers realize and after making every possible provision to prevent mishap to life and limb they are united in the opinion that the workman injured in their service while engaged in the proper performance of his duties should receive adequate compensation under a well-balanced business form of administration. The opposition is to a bill which teems with anomalies and inconsistencies and suggests the possibility of much tiresome litigation—arising out of the overlapping of the trades as classified under the act.

It is understood that the government recognizes that the proposed measure has its shortcomings and that amendments will be made later, but this does not alter the fact that the bill is likely to become law under the present status of affairs, neither does it compensate the employers for the injustice of having the act administered by a government-appointed commission who will have such power as to enable them to interpret their own powers and sit in judgment upon their own decisions.

As it stands, the act is one of the crudest attempts to legislate the vexed question of compensation ever made.

Canadian Municipalities Need Controlling Influence

NOT long since, the London correspondent of this journal discussed the advisability of having some central authority, such as the Local Government Board in England, to control municipal borrowing in Canada, it having been argued that some such authority would tend to place Canadian municipal credit upon a better basis in financial centres. With this idea we are thoroughly in accord, for undoubtedly Canada is suffering at the moment from the effects of bad management in her towns and cities.

During the last few years the country has been passing through a period of reckless irresponsibility in financial affairs, and the relation between capital and current expenditure has been almost entirely overlooked. Perhaps the worst feature of it is that in many cases while money was being squandered in one direction legitimate enterprise was being stinted in another—as a single example of which may be cited the miserably inadequate appropriation made in the first instance for the Toronto filtration plant, which was found to be hopelessly too small before it was half finished.

The crying need of a Municipal Department is becoming more apparent and its feasibility has been the topic of considerable discussion. Particularly is this the case in Ontario, where it is thought that a department of the provincial government might accomplish much in the way of acting as a restraining and guiding influence upon the lesser municipalities in particular. It is contended, with much reason we believe, that a capable Minister at the head of such a government department would soon become a leader of public opinion in municipal affairs. Public opinion on matters municipal is moribund—a condition which is not difficult to understand when one considers by what incompetent men the taxpaying resources of many of our towns and cities have been exploited of late.

One of the objections is that it would be almost impossible to find men of sufficiently broad experience to administer the affairs of such a department. This is mere quibbling, for in both Toronto and Montreal there are at least a dozen men competent to render excellent service—municipal engineers who have graduated into consulting practice and retained the essence of many years' broad experience in financing and carrying out municipal work. Such men are to be obtained, but of course they have their price. A salary of $10,000 a year would perhaps attract the right kind of men and if such a figure were paid and a department were organized for every province, with perhaps a supreme authority under federal control, money would be saved to the country many times over.

The very life of our progress depends upon our maintaining high municipal credit. Is this being done under the present system of municipal administration?

Engineering Prospects and Opportunities*

By F. H. Fay†

THE future of engineering is bright. Opportunities are expanding. The world is coming to expect and to demand a higher standard of the engineer and of engineering. Engineering is the oldest of all professions, and dates from the earliest and most elementary civilization; but it is only within comparatively recent years that it has become recognized as a distinct profession, and we must still look to the future for that full recognition to which we engineers believe the profession is entitled.

In every field of activity the world is coming more and more to depend and rely upon engineers. But to meet these demands, engineers themselves must grow and become broader men. The successful engineer of today and of tomorrow cannot be like the engineer of yesterday, who too often would "retire into the technical recesses of his professional work and content himself with being the servant of other men." The engineer of to-day should be a broad-gauge man, aggressive, alert, in touch with public questions outside his own narrow field, and a leader—not a follower—of men. It is upon the development of the qualities in engineers themselves that the whole future success of the profession depends.

The best technical school training for an engineer is one which gives a thorough grounding in the fundamental subjects of science and engineering without frills and specialties. In response to popular demand, there has been in most of our technical schools during the past few years, a tendency to too high a degree of specialization. Fortunately, a reaction is setting in, and in the best technical schools to-day, courses are being rearranged so as to give the student a more thorough training in science and the general principles of engineering, with less specialization.

There is one quality of highest importance to the success of the young engineer, which cannot be taught in schools and which he must gain for himself, and that is the ability to properly meet and mingle with his fellow-men. In other words, he should be what is popularly known as a "mixer," and failure in this direction is responsible for the lack of, or limited, success, of many an engineer who has the other requisites, and who but for this lack would undoubtedly achieve a far higher position.

The engineer should be a manager, and should give orders to others who can do the work under his direction as well as he himself could do it with the situation reversed. It should not be considered unprofessional for an engineer to be a capitalist, and, when he takes his proper place as promoter and organizer and shares in the profits of engineering enterprises, he will no longer be taunted with the saying that "an engineer is only good to spend other people's money." It is by acquiring individual strength that the engineer can give strength to the profession. It is well known that engineers of admitted proficiency often have to work under the direction of men who are unfitted by education and experience to direct engineering work. This is because the engineer is a workman while the other party belongs to the class of "managers." The engineer has not reached his proper rank until he can hold the position of manager, as well as that of a designer and supervisor of work.

Engineers themselves are frequently responsible for the low estimate which the public places upon the value of engineering services. Chief engineers of corporations and public boards too often make the mistake of hiring engineering assistants at the lowest possible wage, under the false impression that by such rigid economy they are enhancing their own value in the minds of their employers.

Such practices do grave injury to the whole profession and cheapen it in the estimation of the public. Furthermore, they tend to react to the disadvantage even of the chief engineer, for his employers will reason that if the rank and file of engineers can be hired so cheaply, engineers as a whole are a cheap lot, and high salaries are not necessary in any grade, even that of the chief engineer himself. The chief engineer who pays a fair wage, taking account of the time and money which the young engineer has spent in securing his education and training (his working capital), will not only secure better, more loyal and more efficient service, but will help to raise the standard of the whole profession.

Preliminary plans are being drawn up by an English firm of engineers for the Lachine Rapids Power Company. It is proposed to develop hydro-electric power on the north and south sides of Heron Island, situated in the centre of the Lachine Rapids, near Montreal. Should the project be carried out it will entail the expenditure of at least $6,000,000, the idea being to supply power to Montreal industries.

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* Extract from the Presidential Address before the Boston Society of Civil Engineers at the recent Annual Meeting.

† Division Engineer, Public Works Department, Boston, Mass.

Design and Operation of Tremies for Depositing Subaqueous Concrete

By J. R. Middleton, Assistant Engineer-in-Charge C. P. R. Bridge, Pitt River

THE use of the tremie as a means of placing concrete under water is discouraged by a great many engineers, who are inclined to look upon this method as a last expedient and allowable only in cases where the use of the deep sea sealing bucket is impossible. It must be admitted that this aversion is frequently quite justified, as on a great many jobs the most amateurish attempts are made at this class of work. In the hope that it may be of interest to readers who have not as yet had occasion to use tremies, the writer ventures to give a few hints, gleaned from experience, on their design and operation.

Principal of Operation

A tremie consists essentially of a pipe, of the necessary length to reach bottom, provided with a hopper at the upper end for receiving the batches. The whole is suspended vertically in such a way that it reaches bottom, and may be raised as the work progresses. Assuming for the moment that the preliminaries, which will be looked into later, have been attended to, and that the work is well under way, then the following conditions should obtain: (1) The pipe should be absolutely free from water at all times; (2) as each fresh batch is deposited in the hopper it should slide easily down the pipe for a few feet by its own weight, or by a slight raising of the tremie. The first condition requires that the pipe be water-tight throughout the whole of its submerged length, and that its lower end project into the deposited mass a distance sufficient to prevent any influx of water. The second implies that the concrete is mixed "wet" enough to flow easily. This "soupy" condition not only facilitates its passage through the pipe, but assures also that a fairly level surface will be obtained at the bottom without an undue number of shifts in the tremie position. From the above it will be seen that, under ideal conditions, each single batch is deposited below the surface of the mass, and never, while retaining its identity as a batch, comes in contact with the water. The mass surface, the only concrete exposed to the water, should never be disturbed sufficiently to cause any serious wash.

Design

The most satisfactory tremies have been constructed as follows: The hopper was built of sheet iron, 4 x 4 feet, with vertical sides for a depth of 9 inches. In a further depth of 1 foot 3 inches the sides are battered in to leave a hole 12 x 12 inches. They are then drawn in to form a pipe just large enough to be inserted into a short length of 10 inch W. I. pipe fitted with a flange joint on the lower end. The hopper is joined to the short pipe by four vertical riveted bands, and the joint, which should always be kept above water is caulked so as to be "grout-tight." The remainder of the tremie is made up of lengths of 10 inch W. I. pipe, with screw joints, except the top one, which is flanged to connect with the short piece riveted to the hopper. All screw joints should be greased and the flange joint gasketed to insure water-tightness. A heavy band is riveted round the top edge of the hopper for reinforcement, and to carry a cable sling for hoisting purposes. Sealing has been carried out at a depth of almost 100 feet with tremies of this description, the only difference being that spiral riveted pipe with flanged and gasketed joints was substituted for the W. I., in order to save weight.

Handling and Inspection

The most satisfactory method of handling the tremie, and the only method in deep work, is by derrick. In shallow water, however, where only one derrick is available both for supplying the concrete and moving the tremie, a crib support may be built on the cofferdam struts, and the derrick hooked on only when it is necessary to raise it a little. A separate derrick is much preferable, owing to the fact that the spring in the boom helps to jar each batch through the pipe, and also because of greater speed. On starting work, the tremie is lowered till it rests on bottom, and is then raised three or four inches in order to give the first batch room to expel the water. A couple of cement sacks placed in the pipe act as a plug and prevent any tendency of the water to work through the first batch. The first, or at least the second batch, should drive all the water out through the pipe bottom and seal it. A light lowered at intervals into the pipe will soon show up any slight leak.

When working properly, the pipe will give a peculiar "roaring" sound as each batch drops down. Should the bottom not be sealing well, a column of water will shoot up the pipe after each batch. In cases where there is a leak in the pipe above the seal, it will be found that shortly after each batch is deposited there will be a "boiling up" of water through the batch which will wash most of the cement and a good deal of the sand to the surface, forming a rich grout at the top and leaving washed gravel below. This is caused by the accumulated water from the leak lying on the surface of the concrete in the pipe and being forced up through each new batch as it is dropped into place. It probably is more harmful to the concrete than even faulty sealing of the tremie bottom. When concreting in piled foundations, it will sometimes be found that, although the pipe is apparently quite watertight and the lower end close enough to the bottom to seal properly, there is still trouble from wash and excessive clogging. This usually indicates that the free exit at the pipe bottom is partially closed by an obstruction, such as a "nest" of piles, and a shift in the tremie position will usually get over the trouble. Should the bottom, as is frequently the case, be composed of river silt or clay which has been converted into a semi-liquid mud by the action of the water jet when driving piles, it will be found that the concrete will sink below the surface of the mud and spread itself imperfectly over the bottom, forming a very poor seal, and being full of mud "pockets." In cases of this kind, the most satisfactory method is to first lay a thin sealing course with the idea of confining the mud. After setting, the whole seal is cleaned over with a hydraulic sand elevator, and most of the surface mud removed, after which the main seal may be deposited with practically no further trouble from mud.

Constructional Features of the Georgia-Harris Viaduct at Vancouver, B. C.

CONSIDERABLE progress has been made during the spring and winter months with the construction of the Georgia-Harris viaduct now being erected for the city of Vancouver by Messrs. J. McDiarmid & Company, of Winnipeg and Vancouver. This structure stretches from the west end of Harris Street in a westerly direction to the eastern end of Georgia Street, crossing over an arm of False Creek, the properties of the Canadian Pacific Railway, British Columbia Electric Railway and the Great Northern Railway. The viaduct was designed by Mr. C. A. P. Turner, the inventor and patentee of the "Mushroom" system of reinforced concrete construction, and is intended to relieve the problem of handling heavy traffic between the west and east districts of the city.

View of Warren trusses, looking east.

The total length is 2,854 feet and the outside width is 66 feet, comprising a central roadway 53 feet wide carrying a double track for street cars, and two 6 ft. 6 in. sidewalks. For about 900 feet from the Georgia Street end the structure consists of four parallel Warren continuous trusses, the erection of which is almost completed, over 900 tons of steel having been put in place in a little over 8 weeks. From the end of the steel trusses for a distance of 280 feet there will be seven standard Mushroom spans varying in width from 37 ft. 9 in. to 43 ft. 6 in. the latter being the largest Mushroom span on the structure. The succeeding stretch of 150 feet consists of 3 parallel reinforced concrete girders with two spans of about 60 ft. which are cantilevered out from each end support. Only the footings on this portion have as yet been completed. Owing to the nature of the ground here, most of which is fill, it was found necessary to carry the footings on piles of which 10 to 13 were required for each footing. In passing over the site of the old Royal City Mills (now owned by the B. C. Electrical Railway Company), it became necessary to use steel points on a large number of the piles as in some places there was over 14 ft. of fill consisting of old slabs, logs and mill waste.

The viaduct is carried over the Great Northern Railway tracks on continuous girders of reinforced concrete with spans varying from 50 to 83 feet, the length of the spans having been determined by the position of the tracks. Next comes the arch over False Creek with a span of 123 feet cantilevered out from each support. This is followed by 12 spans of the Mushroom type ranging from 25 ft. to 30 ft. after which 69 ft. of fill connects with the Harris Street end. The first twelve spans projecting from Harris Street were completed some time ago. Concrete is being placed by Ainsley's patent spouting system, in connection with which there are two 190-foot towers in use at each end of the viaduct. About 600 feet of the structure can be concreted before it is necessary to move the towers to a new position.

The concrete caissons, 12 feet in diameter and 40 feet high of which there are six altogether have been sunk in place and filled with concrete. These caissons support the foundations in False Creek. Almost all of the reinforcing steel required for the entire structure has been bent ready for placing. Owing to the length of this steel—some of it being over 110 feet long—it was found difficult to get delivery from the mills and resort was made to splicing by means of turn-buckles. A number of the rods have as many as 17 bends and weigh nearly 500 lbs. Despite their unwieldy size, the rods were handled and bent with economy and ease by four competent workmen.

Rapid progress has been made in fashioning the high class ornamental cast stone hand railings and lamp standards of modified Corinthian columns which will add the finishing touches to the viaduct. Nearly all of the stone has been cast and a large proportion is completed and ready for erection, while a small stretch is already in position. The stone is being cast directly on the job and to judge from it's attractive appearance should provide a fitting form of decoration to a splendid example of modern viaduct construction.

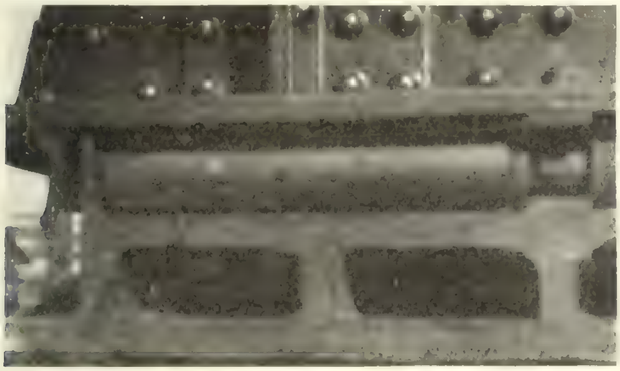
The false work for the arch span over False Creek

Warren trusses, showing temporary wooden bents carrying structure before rivetting.

is being carried on 42 piles placed in six rows, three on each side, a 35-foot channel being left to allow the owners of the adjoining waterfront the use of the waterway during the progress of construction.

The form work for that portion of the structure carried by the Warren trusses is an interesting piece of work, the deck being carried on 8 x 16-inch timbers on 12-foot centers, the 8 x 16-inch timbers resting on the lower chords of the Warren trusses, every alternate one being cantilevered out from the trusses to carry sidewalks forms. Expansion rollers are used at the base of the legs which support the Warren trusses the expansion in the trusses being taken care of by four such sets of rollers while provision for the expansion of the concrete portion of the viaduct is made where necessary.

The telephone wires and gas mains across the viaduct will be hung from the under side of the deck while the conduits for the B. C. Electric Railway Company's wires are embedded in the concrete sidewalks. A few statistics of the amount of material required on this work may prove interesting. For reinforcing purposes, 1,200,000 lbs. of steel will enter into the bridge as well as 1,200 tons of structural steel. For the concrete portions upwards of 20,000 cubic yards of concrete are required, and for the foundations, etc., nearly 30,000 piles will be driven before the completion of the work. In the composition of the concrete for the viaduct there enters 24,000 barrels of cement and 26,000 cubic yards of sand and gravel. The structure at its highest point will be 40 feet above the railway tracks underneath, and this height is maintained almost throughout the entire length of the viaduct, namely, 2,854 feet. The work is being carried out under the direct supervision of Mr. A. P. Hueckel, district engineer for Mr. C. A. P. Turner, the consulting engineer and Mr. F. L. Fellowes, supervising city engineer of Vancouver. Mr. T. Bagford, local manager for Messrs. J. McDiarmid & Company, has charge of the actual construction. The total outlay involved will be approximately $500,000.


Portion of roller nest which allows for the expansion of the steel trusses.

"The Influence of Ice on Waterpower Developments" was the subject of an interesting lecture given before the Montreal Engineers' club recently by Professor H. T. Barnes of McGill University. The problem with which Dr. Barnes is at present engaged and which he explained by photographic illustrations, is to keep the great northern waterways open in the winter months. His experiments included the idea of diagonal booms above the dam, and the forcing of hot air or steam on the surface of the water at the head of the dam.

Making Blueprints from Blueprints

The making of a blueprint from a blueprint is described by a correspondent as follows: To obtain good results, a clear, sharp and rather dark print is essential, for if it is blurred or light, it will not reproduce satisfactorily.

The method consists of coating the print with a little kerosene and then printing immediately. The oil used will not affect the reproduction of the new print, unless it is applied very thickly, nor will it spoil the original, as the oil soon dries, leaving the print in as good condition as before. This process will also work perfectly when it is desired to make prints from heavy drawings. It has been used with suceess to make blueprints from printed matter. To make the original perfectly transparent, apply a coat of boiling hot paraffin.

The Failure of Dams

A paper on "The failure of dams" was read last month before the Liverpool Engineering Society by Mr. J. R. Davidson. The author said that unsound foundations had been the most fertile source of disaster to masonry and concrete dams, while in the case of earthen embankments either inadequate provision for dealing with floods or faulty arrangements for drawing off water had been chiefly responsible for failure. Two of the three masonry or concrete dams which he referred to had failed in quite different ways through faulty foundations. The third was a case of pure overturning, which is unusual but none the less instructive. The remaining examples were two earth banks, which illustrated each of the above-mentioned causes of failure. After referring to the troubles which brought about the failures, Mr. Davidson said that the lessons to be learnt might be broadly summarized as follows:—A gravity dam of masonry should be wholly founded on rock; tensions should be practically nonexistent in a masonry dam; in an earth dam settlement should be provided for, and unequal settlement prevented; adequate provision should be made for exceptional floods under all conditions; and a secure foundation and prevention of uplifting were necessary in masonry and concrete dams.

North Toronto's Extension Sewerage Scheme

An extensive sewerage scheme for North Toronto district has been submitted to the Works Committee by Commissioner Harris in a detailed report, in which he estimates that the whole cost of the work, including two sewage disposal plants, a complete system of trunk, lateral and storm outlet sewers, and additional trunk sewer accommodations, will amount to $4,144,256. The additional trunk sewer accommodation is required to drain the neighboring watersheds at present outside the city limits. Of the expenditure the city at large will be asked to contribute $2,781,945, and the ratepayers benefited will be assessed for $1,362,311. The scheme is divided into two districts, north and south, with Eglinton Avenue roughly as the line of demarcation. A feature of the Commissioner's recommendation is that legislation will be asked for power to assess outside areas, upon annexation, which share in this provision for drainage. Two storm outlet sewers are to be constructed, one through the Waterworks Park, and the other from Bayview Avenue to the Don River, through private property. A sewage disposal plant will also be built.

Explosions in Sewers—An Investigation of Causes and Preventive Measures

By H. J. Kellogg, City Engineer of New Haven, Conn.

THE Department of Public Works of New Haven, Conn., has been for the past year and is still investigating the causes of explosions in sewers and underground conduits, and endeavoring to find means of preventing such explosions. In New Haven, about twenty years ago, while four men were cleaning a 54-inch circular brick sewer, an explosion knocked the men down and momentarily stunned them, broke a pick handle and bent the framework of the iron truck which was used to carry the sewage deposits, and apparently exhausted the oxygen in the air so that the men were nearly suffocated before they could reach the manhole opening. Incidentally, it blew the water out of the sewer, a great deal of it being forced back through the house connections into the plumbing appliances. Two of the men were disabled for six months or more. One of them, Daniel Lawler, who is now superintendent of sewers, said that there appeared to be a great ball of fire coming like a bolt of lightning from the upper end of the sewer. There was a gas plant nearby, and in those days the manufacture of by-products from gas wastes was very limited, also gas drips were run directly into the sewer where it was convenient; and it is believed that illuminating gas had been ignited by the lanterns carried by the men.

About a year ago, in another New Haven sewer, 42-inch egg-shaped brick, there was an explosion while men were inside cleaning it, and they were burned about the faces and hands but were not otherwise injured. In this case illuminating gas did not appear to be the cause, but it was believed to be due to waste benzine or naphtha mixture used by the National Paper Box & Paper Company for cleaning lithographic stones. The evidences against this was by no means strong, but a gasoline odor was noticed by the men before they entered the sewer, and no garages were known of located above that point. The manholes had been left open for a length of time that was thought sufficient to clear the sewer atmosphere, and ordinary lanterns were carried. This second explosion led to the adoption by the sewer department of a small, neatly-made dry battery lantern carrying a small mazda lamp. Smoking and lighting of matches in the sewer is forbidden, and it is believed that this will prevent explosions while men are working in the sewers.

These are the only instances in New Haven where lives have been endangered from sewer explosions, although several small explosions have been caused by unknown agencies. The earliest of these latter explosions occurred in 1886, when the arch was blown completely off of a 60-inch circular brick sewer for about fifty feet each side of a railroad track which it passed under. No information was ever obtained as to the cause. This is the only instance in that city of damage to a sewer by an explosion.

A number of explosions have occurred in underground wire conduits, some of them serious and expensive. In Bridgeport, about two years ago, a manhole cover was blown off by ignited illuminating gas, and the gas continued to burn for hours before it could be stopped, the sheaths around the cables and the insulations being destroyed. In the same city, two years earlier, an explosion in a conduit manhole broke forty panes of glass in adjacent buildings. A riser pipe had been cut off just above the curb, and a ventilator cap on this permitted the escape from the manhole of any illuminating gas. A boy striking a match on this ventilator cap started the trouble. In the same city a spark given off by a trolley car on a gritty rail touched off a blast that blew up 675 feet of ducts. The telephone company of Hartford, Conn., received $5,000 damages from the gas company of that city for an explosion caused by illuminating gas. Ventilated manhole covers have checked this line of conduit troubles, but a bad break in a gas main would threaten the underground system, as trolley car wheels or hose shoes sprinkle sparks. In Columbus, Ohio, according to C. J. Lauer, chief of the Fire Department, there have been two explosions in underground conduits for telegraph and telephone wires, caused by accumulations of natural gas which were touched off by the fire engines passing over the manholes and igniting the accumulated gas. In one of these instances a heavy telephone manhole cover was blown off and some damage done to the wiring inside.

Pittsburgh Holds the Record

Pittsburgh holds the world's record for the wreck of a sewer from an explosion, and no community cares to wrest that distinction from it. It is hard to believe that over a mile of an 8-foot sewer could have been completely shattered from one convulsion; but so it was, and it may cost half a million dollars to repair the damage. The engineers of the Department of Public Works have been able to assign no cause for the explosion.

In Charleston an employee lighted a cigarette and threw a match into a manhole just uncovered. At another time two men were caught by a flash in a sewer which singed their hair. In Philadelphia an explosion attributed to gasoline vapor injured several men recently. On another occasion a suspicious smell was noticed upon opening a sewer manhole, and a blazing paper was thrown in, resulting in a column of flame about 40 feet high, due to gasoline from a nearby factory. About two years ago two men were killed in the city owing to a leaky gas main which ran parallel with the sewer, and about a year and a half ago a man was burned from gasoline from a dry cleaning shop. In Detroit, on January 28, 1914, an explosion occurred due to gasoline which caused damages running into the thousands, and the force of which extended for a distance of 19,000 feet.

George H. Norton, deputy engineer commissioner of Buffalo, N.Y., wrote: "For three years past, at periods of thawing weather following frost and heavy snow, we have had serious complaint from gas odor in some of our sewers. This has been traced down and found to be due to the use of the railroads of what is called hydrocarbon oil, which is used by them to prevent freezing of their switches and interlocking plates in the passenger station yards and at other congested points. An examination was made by our city chemist, and he reports that at low temperatures this oil will crystallize, that such crystals are soluble in water, and for this reason he thinks that the gases have passed the ordinary vent sewer trap. The gases arising from this oil are apparently highly explosive, and could readily be the cause of a serious explosion. This oil is a by-product from the Pintsch gas used for car lighting. After a lengthy consultation with the railroad authorities, they have agreed to discontinue the use of this oil in their yards."

Hartford had two serious explosions in sewers in 1913, one lifting a manhole head and throwing several covers into the air and shattering windows in adjoining houses. This and the second also took place near the works of the Gas Light Company, and suits against the company were brought by property owners.

The inspector of combustibles of New York City reported that since June 5, 1912, there have been eleven sewer explosions, but as conditions in the sewers are so complex and opportunities for observation so limited no definite knowledge could be obtained of the causes of the explosions. As far as they can judge, however, the probable causes are gasoline, illuminating gas and calcium carbide. "Prior to the regulation requiring the installation of oil separators in garages, the larger number of sewer explosions was limited to what is known as the garage zone, lying west of Broadway to the Hudson river between 40th and 60th streets. Since their installation, the number of explosions has been greatly reduced. Illuminating gas enters the sewers from ruptured, corroded or broken gas mains or from leaky joints, and when mixed in the proper proportions with air forms an explosive mixture. Calcium carbide, which is used in garages for generating light, may be thrown into the sewer, and when in contact with water generates acetylene gas, which is an intense explosive and is also auto-combustible, so that in many instances it may be lighted by its own heat generated in evolving the acetylene. The vapors of gasoline and illuminating gas require an open flame to ignite them, but how this occurs in sewers it is impossible to tell; but in vaults and in conduits the igniting spark is furnished in a number of cases by electrical apparatus, such as switchboards, sump pumps, short-circuiting, etc. . . . In relation to places where oil is stored, the oil separator is the only method at present under the regulation for preventing volatile inflammable oil from discharging into the sewer."

It is difficult to compel garages to install oil separators, however. A letter from the Ansonia Manufacturing Company, of New York, which makes oil separators, says: "The garage owners at one time combined and fought the ordinance in the courts, and after several appeals finally lost their case, with the result that this matter will be pushed harder than ever. Their contention was that it was an injustice to impose such expense on the small garage owners and individuals, because they felt it was entirely out of their means to comply with this ruling. . . . . . Some of the boroughs make a distinction between private and public garages by calling any garage which stores more than two cars a public garage, and make only public garages subject to the ordinance."

Illuminating gases can be kept out of the sewers more easily than out of wire conduits, as the latter lie nearer the surface and afford better channels for the escape of the gas that may accumulate under the nearly gas-tight pavements. In New Britain it is intended to have ducts calked with oakum and some impervious substance like tallow that can easily be taken out and replaced. Also greater care is generally taken now in laying gas mains and calking joints. New Haven is considering requiring every garage to have an inexpensive sump or catch basin for receiving waste oils, and that the Department of Public Works be notified whenever these need cleaning and will then clean the basins and dispose of the dangerous matter in a way to prevent explosions and fires. This probably will be adopted for dry cleaning shops only. Garage sumps would not be likely to retain the oil, which would probably be evaporated, while oil separators have a receptacle to catch and hold all oils.

One volume of gasoline is said by Professor Dean to produce 141 volumes of vapor, and one part of this vapor to 62½ parts of air to furnish the best mixture for complete combustion. On this basis, one gallon of gasoline would furnish a mixture of maximum explosiveness for about 150 feet of 42-inch sewer, although, of course, consideration should be had of the time required to vaporize the oil, the motion of the air in the sewer and other factors which would complicate the problem. Gasoline vapor is heavier than air, while illuminating gases are lighter; therefore ventilated manhole covers furnish outlets for the latter, but gasoline vapors will not escape in this way. But good ventilation of the sewers would appear to minimize the danger, especially from illuminating gas. (In New Haven there appears to be no method of ventilating the sewers, either through manhole heads or house connections).

Protective Ordinances

On the subject of ordinances designed to protect sewers from combustibles, Mr. Kellogg quotes the Washington ordinance as being perhaps as good as any, this being as follows: "No person shall make or maintain any connection with any public sewer or appurtenance thereof whereby there may be conveyed into the same any hot, suffocating, corrosive, inflammable or explosive liquid, gas, vapor, substance or material of any kind; and no person shall cause to enter or flow into any public sewer or appurtenance thereof any hot, corrosive, suffocating, inflammable or explosive liquid, gas, vapor, substance or material of any kind; provided, that the provisions of this paragraph shall not apply to water from ordinary hot water boilers of residences." There are also rules for the installation of garage traps. The virtue of such an ordinance, however, lies in the enforcement of it, and all cities, both large and small, find this to be very difficult, and probably all are aware that there are numerous violations without being able to detect them.

All sand intended for use in concrete should be thoroughly washed if it shows signs of vegetable matter, mud, or other impurities. The following is a simple method of cleaning: Build a platform about 12 ft. long by 4 ft. wide, with one end about a foot higher than the other. On the lower end and sides nail 2 by 6-in. boards to hold the sand. Spread the sand over the platform in a layer 3 or 4 in. thick, and wash it with a hose. The washing should be started at the upper end, letting the water run through the sand and out over the board at the bottom. All of the sand should be thoroughly agitated during the washing, so as to allow the water to carry off the dirt. After washing, the sand should be piled up where it will not come in contact with the dirty water. Drain this water off to some suitable outlet and do not use it for mixing the concrete.

Twelve spans of 75 ft. to 90 ft. each across the Maumee River, near Toledo, Ohio.

Permanent Bridges and Their Advantages

By Daniel B. Luten, Consulting Engineer, Indianapolis, Ind.

THE day of permanent bridges has arrived. Temporary bridges have their use where funds are limited, or where it may be necessary subsequently to change the location of the bridge, but it can easily be shown that a permanent bridge, even though considerably higher in first cost than a temporary bridge, will be more economical in the end.

Let us assume, for example, that it be desired to build a 50-ft. bridge and that $1,000 be borrowed at the bank for that purpose on a renewable note bearing interest at six per cent. We will assume the life of the bridge to be that of the average steel hihgway bridge—about twenty-five years. The bridge will require re-flooring at intervals of five years at a cost of $100 each time and will require re-painting at intervals of eight years at a cost of fifty dollars each time.

For the first twenty-five years then, the cost per annum may be found as follows:

Interest on $1,000 at 6 per cent., $60 per annum.	$1,500
Reflooring four times at $100	400
Repainting twice at $50	100
Total	$2,000

or an average of $80 per annum.

Now at the end of twenty-five years it becomes necessary to replace this bridge with a new bridge. If the same kind of a bridge be purchased again, it will be necessary to borrow another $1,000 at the bank, and for the next twenty-five years, therefore, the annual charge for maintenance will be increased by the interest on the second note, making $140 per annum. For the third twenty-five years the annual charge would be $200 per annum, with $3,000 indebtedness at the bank. And at the end of a century, the annual charge for that bridge would be $320 per annum with an indebtedness of $5,000 at the bank.

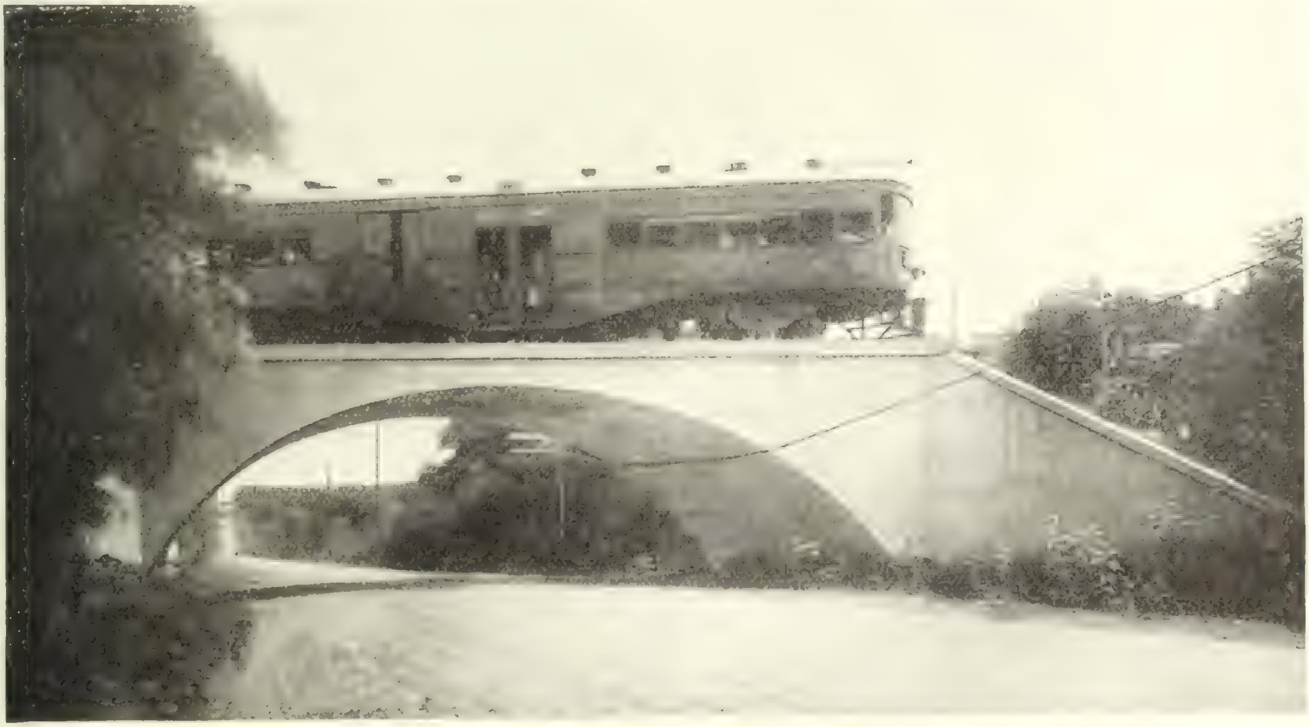
How much better it would have been in the first place to have purchased a permanent bridge even at a price that would have consumed the entire $80 charge for the first twenty-five years as interest, that is, for $1,333.33. This, then, would have been the limit of the indebtedness and the annual charge of $80 would never have been increased. On such a principle as this the State of Kansas has passed a law that a concrete bridge shall always be built where its cost does not exceed by one-third the cost of a steel bridge.

Of course, a business-like community would have a sinking fund to meet the note for the temporary bridge at the end of the first twenty-five years. But this would call for an additional outlay for each year, and if this be taken into consideration and also the fact that money can usually be borrowed by a community at five per cent. on bond issues, instead of the six per cent. we have assumed, it will be found that a permanent bridge would be economical at nearly twice the cost of a bridge that endures but twenty-five years and requires repainting and reflooring in accordance with our assumption.

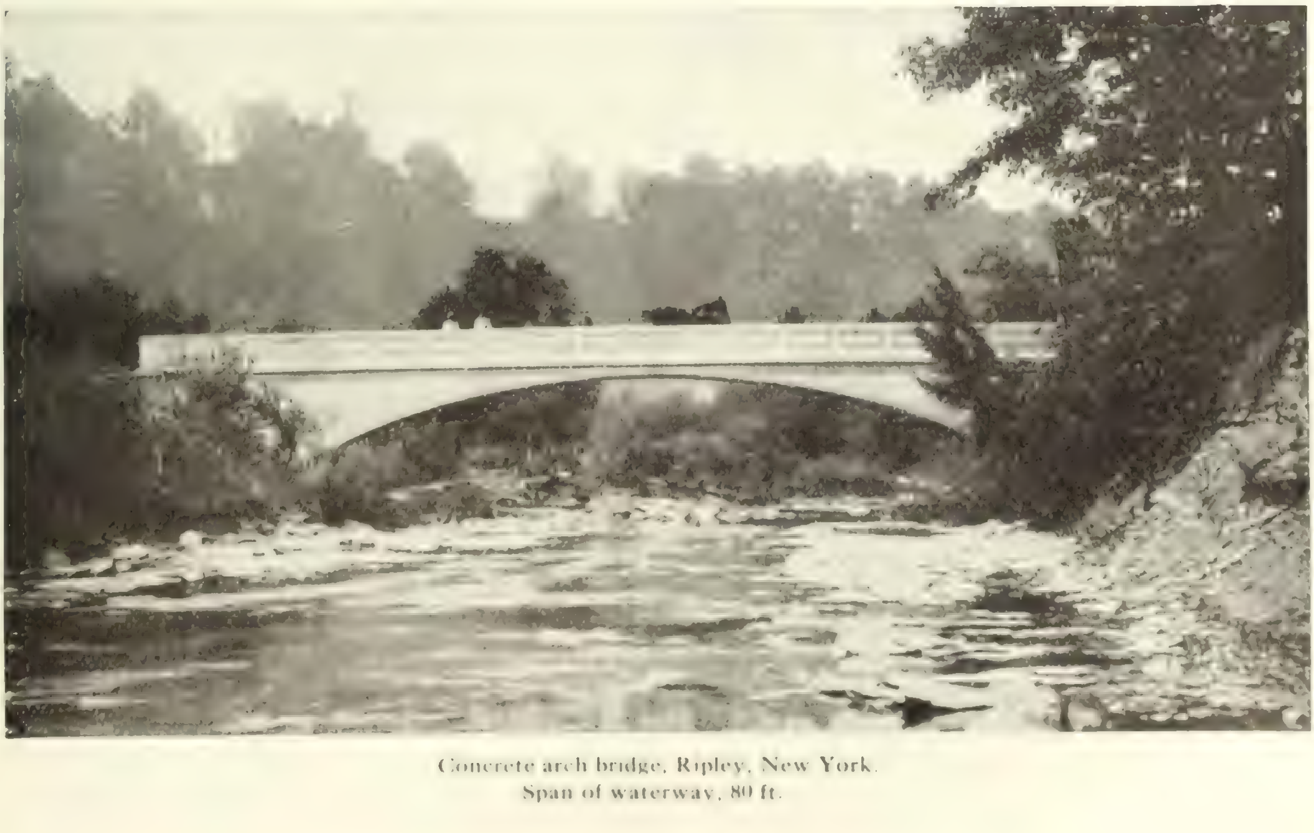
It is possible to design steel and wooden bridges so that they will be reasonably permanent. And the comparison is made here only between an absolutely permanent bridge, such as will be afterwards defined in this article, and the average steel highway bridge as built and maintained in the United States and Canada, and usually for the smaller spans. When a very large bridge is to be erected, competent engineers are usually employed—engineers whose advice may be followed with safety. But for the smaller bridges, such as are shown in the illustrations in this article, it may be desirable to have a better understanding of the requisites of an absolutely permanent bridge.

To be absolutely permanent a bridge must not only be built of permanent materials, but it must also provide for increase in weight and in volume of traffic. With modern hard roads and high speed, it should also carry the roadway itself across the stream or ravine and not have a floor that interrupts in any way the continuity of the suface of the road.

Concrete is one of the most permanent building material known to men. It is as permanent as stone and when reinforced with embedded steel has many of the advantages of steel with the permanence of stone. For the embedded steel is protected against rust by the surrounding concrete, which is a more perfect preservative for steel than any known paint. The concrete absorbs and neutralizes the carbonic acid gas, which, when combined with moisture, is the cause of rust. Moisture alone cannot cause rust, as



Concrete arch bridge on K.C., C.C., & St. J. Ry., St. Joseph, Missouri.
Span 70 ft.; skew 53 degrees.



Concrete arch bridge, Ripley, New York.
Span of waterway, 80 ft.

may be shown by placing a piece of steel or iron in water in which lime has been dissolved—the ordinary lime water purchasable at drug stores. The metal will remain for weeks without rusting, because the lime in the water neutralizes the carbonic acid gas.

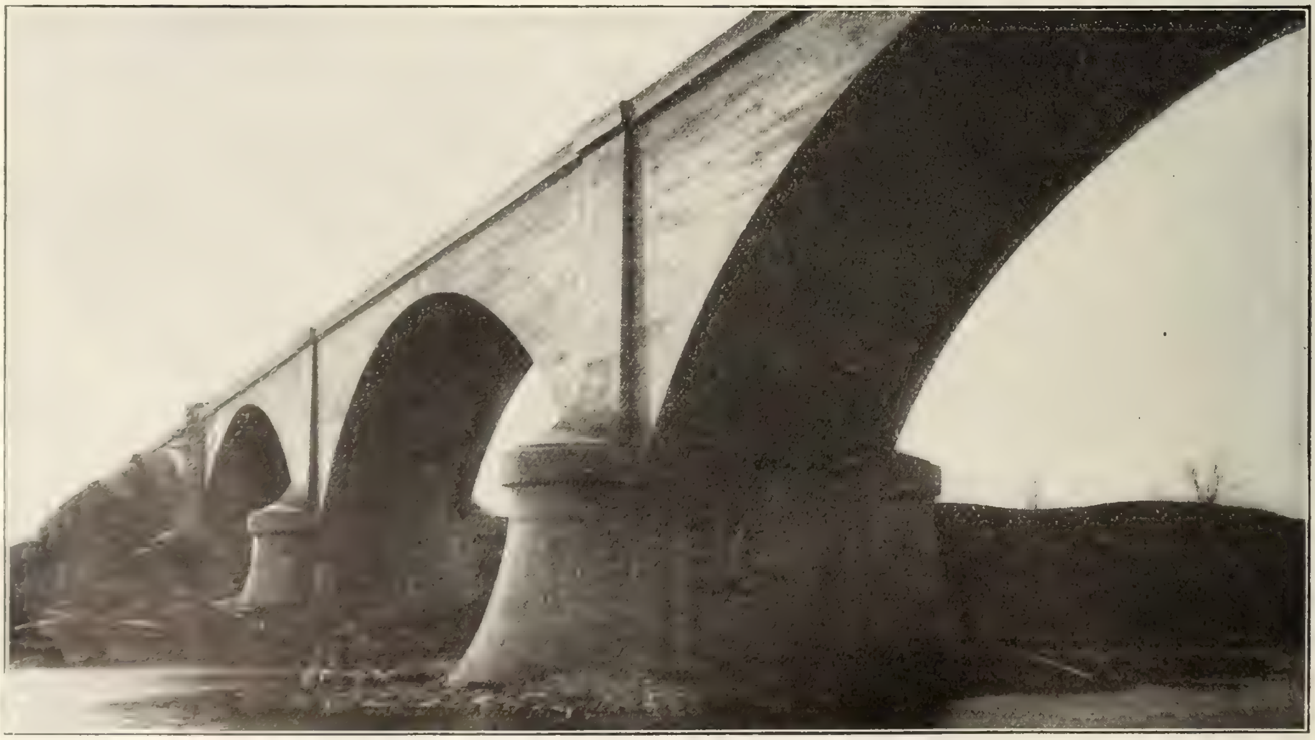
Bridges built of concrete reinforced with embedded steel, therefore, have the first qualification necessary for a permanent bridge. They are rust-proof, frost-proof, fire-proof and flood-proof. The accompanying photographs show the wide distribution and acceptance by the public of such structures. Five of these photographs, all construction views, are of particular interest as showing the construction of five reinforced concrete bridges at widely separated points, under construction at the same time. These five photographs were taken in October, 1913, and represent Cicott Street Bridge, Logansport, Ind., across the Wabash River; Barrington Bridge at Barrington; Rhode Island, in the extreme eastern part of the United States; and Orland Bridge at Orland, California, in the extreme western part of the United States. These bridges each exceed $100,000 in contract price. Another construction view is the Hillsboro' River Bridge at Tampa, Florida, in the extreme southern part of the United States, built at a contract price of about $200,000, and still another view, the Saskatchewan River Bridge at Saskatoon, Sask., in the Great Northwest, built at a contract price of $400,000.

Concrete increases in strength as it grows older, the increase amounting to perhaps fifty per cent. in the year following the first month. The supports are usually removed from beneath a concrete bridge at the end of thirty days. If, then, the bridge can be properly designed to take advantage of the increase in strength of the concrete, the bridge may be expected to grow stronger as it grows older, with an increase as great as fifty per cent. the first year. An arch does take advantage of this property and the concrete arch bridge therefore provides for increase in weight of traffic by increased strength of the bridge as it increases in age. And it is the only type of bridge that has this quality. Even the girder or slab bridge of concrete cannot increase in strength with age, unless it has been designed originally with an excess of steel. And of course it is a well-known fact that steel and wooden bridges begin to grow weaker from the first day of their erection.

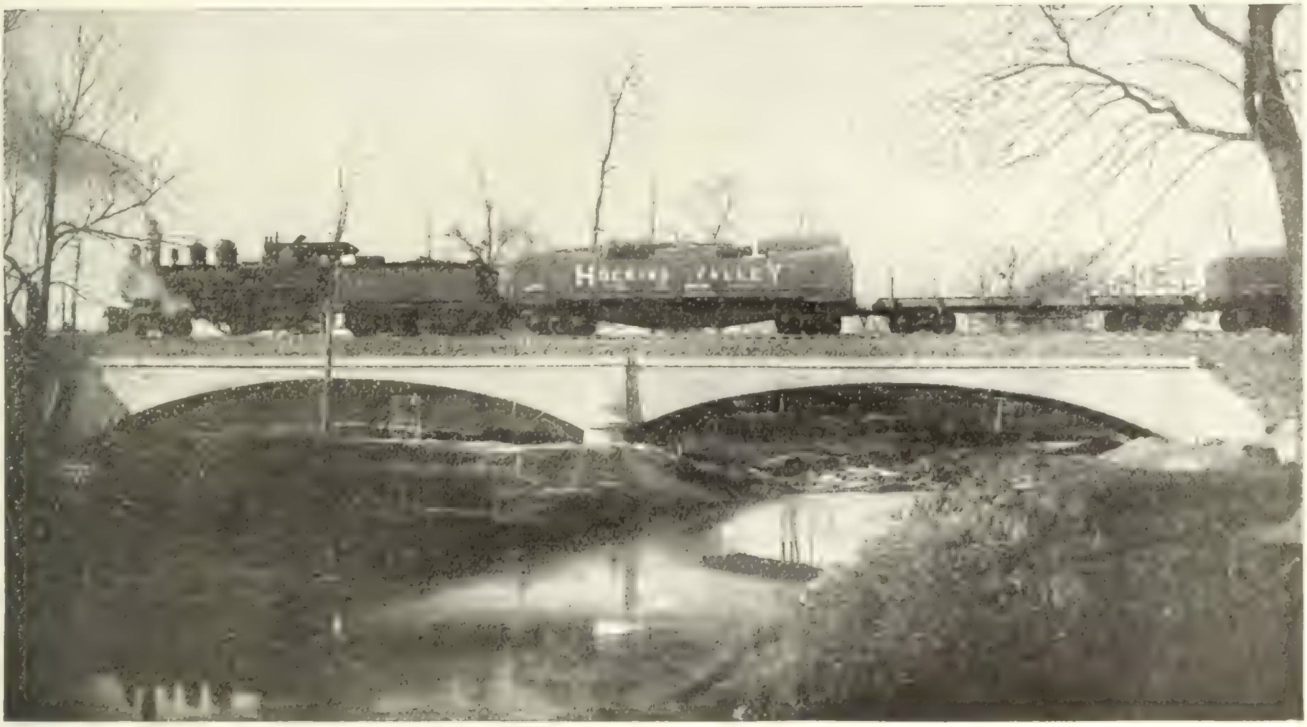
A bridge that increases in strength fifty per cent. in the first year and continues to increase slightly after that as does the concrete arch bridge, provides fully for almost any increase in traffic that may be expected on our highways in the future. Such a bridge is now ordinarily designed for a load of 150 lbs. per square foot or a 20-ton road roller. When this loading is used as the basis of design, the concrete arch bridge in almost all cases will compete successfully with the steel bridge designed for the same loading. And hence it will come well within the limits of economy laid down at the opening of this article.

The other requirement that a bridge should provide for increase in volume of traffic necessitates that its supports be beneath the roadway surface. If, for example, the roadway be supported by trusses at each side which extend above the roadway surface, it is not possible to widen the bridge for future traffic without destroying the superstructure. A second similar bridge could of course be erected beside the first, but only as an unsightly and unsatisfactory solution. If, however, the supports for the bridge be under the roadway, as in the case of a deck girder bridge, or an arch bridge, then the bridge may be widened at any time by simply extending the substructure and adding to its superstructure without destroying the part originally erected; hence there is no loss of the original

(Text concluded on page 493.)

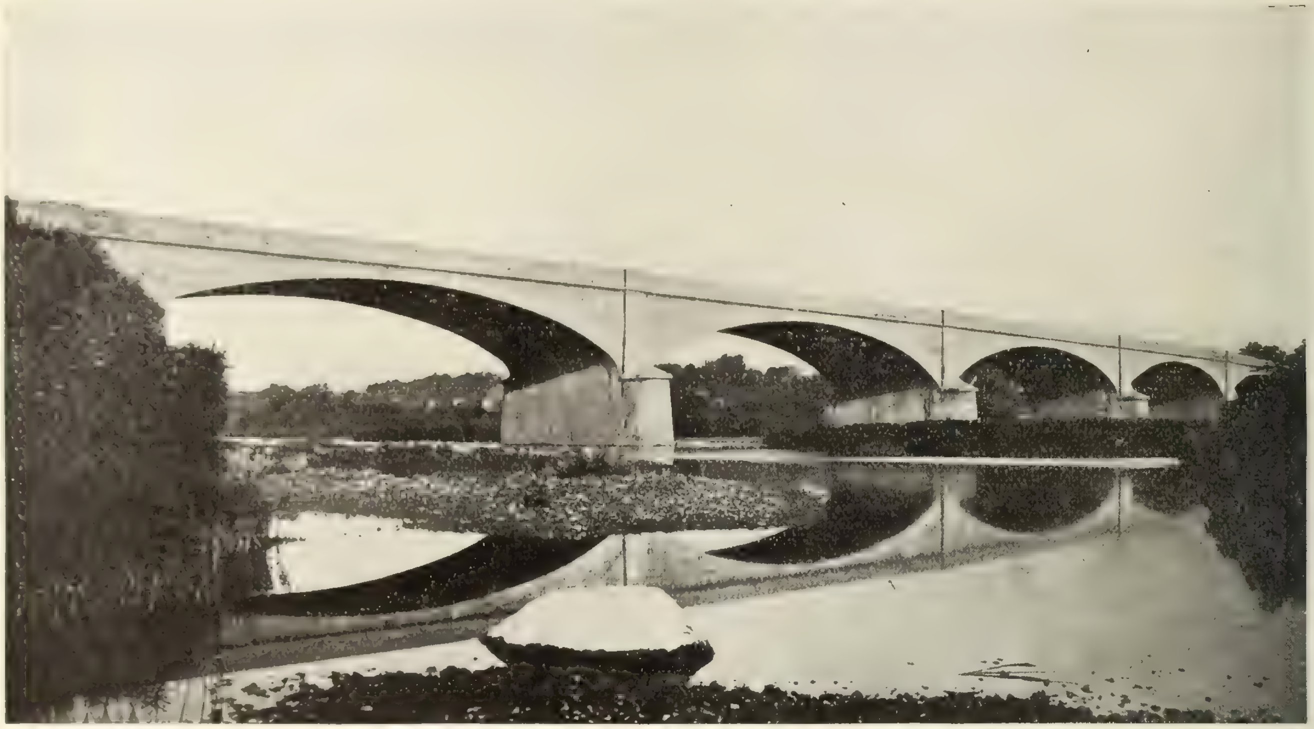


Concrete arch bridge (under construction in 1907) across the Maumee River, near Toledo, Ohio. Twelve spans of 75 ft. to 90 ft. each.

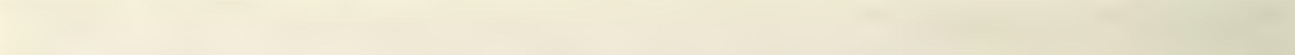


Concrete arch bridge on C. & L. M. Ry Lima, Ohio.
Twin spans of 60 ft. each.

Concrete arch bridge on Pittsburgh Street, Newcastle, Pennsylvania.
Twin spans of 75 ft. each.



Concrete arch bridge on Wayne Street, across Wabash River, Peru, Indiana.
Seven spans of 75 to 100 ft. each.

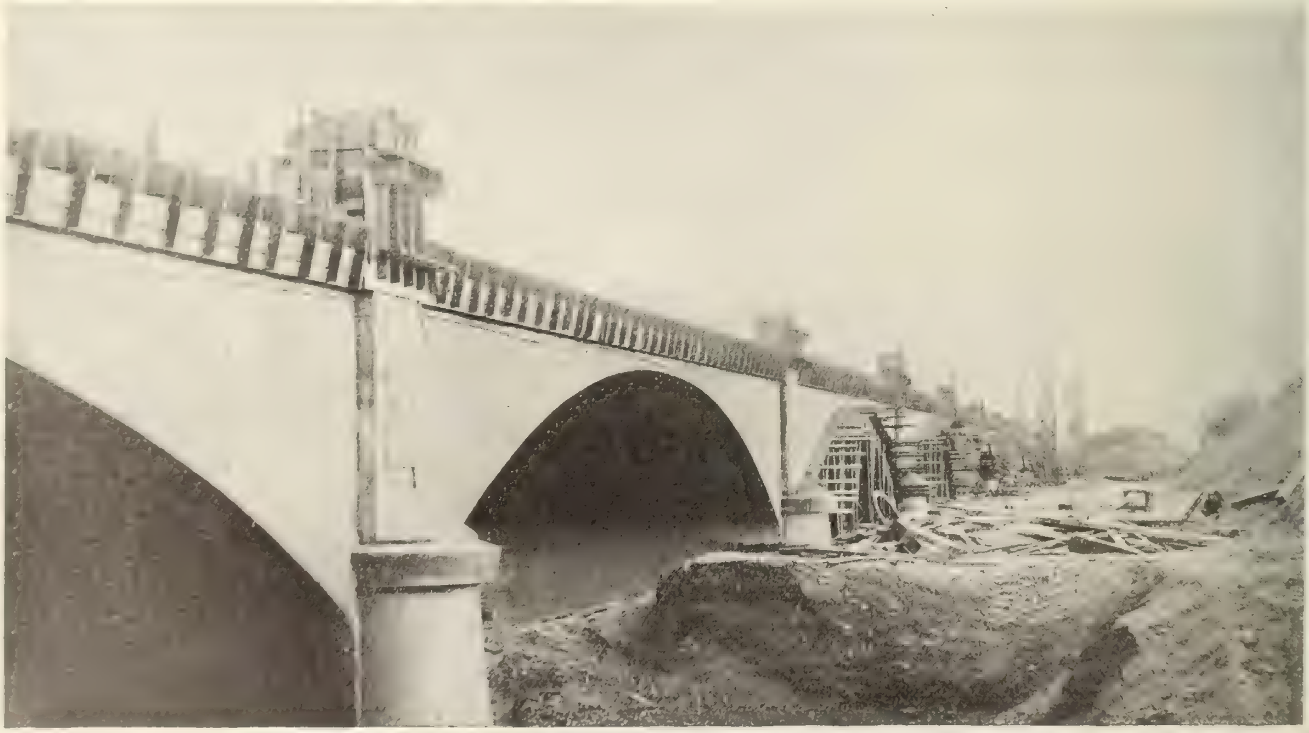


Concrete arch bridge on Eighth Avenue, across Sioux River, Sioux Falls, South Dakota.
Three spans of 72 to 80 ft. each.

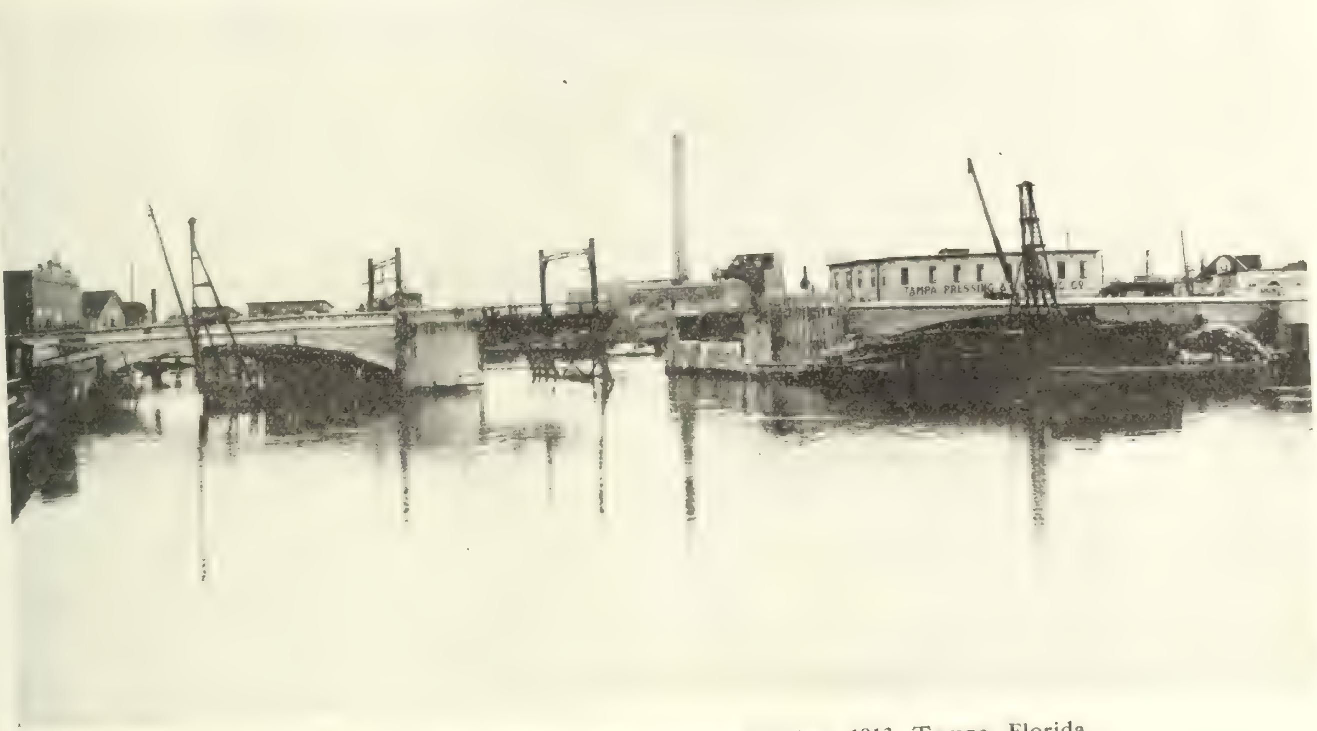
Gravelled roadway over concrete arch bridge, Plainfield, Indiana.
Three spans of 45 to 55 ft. each.

Cicott Street bridge under construction, October 1913, Logansport, Indiana.
Six spans of 96 to 108-ft. each.

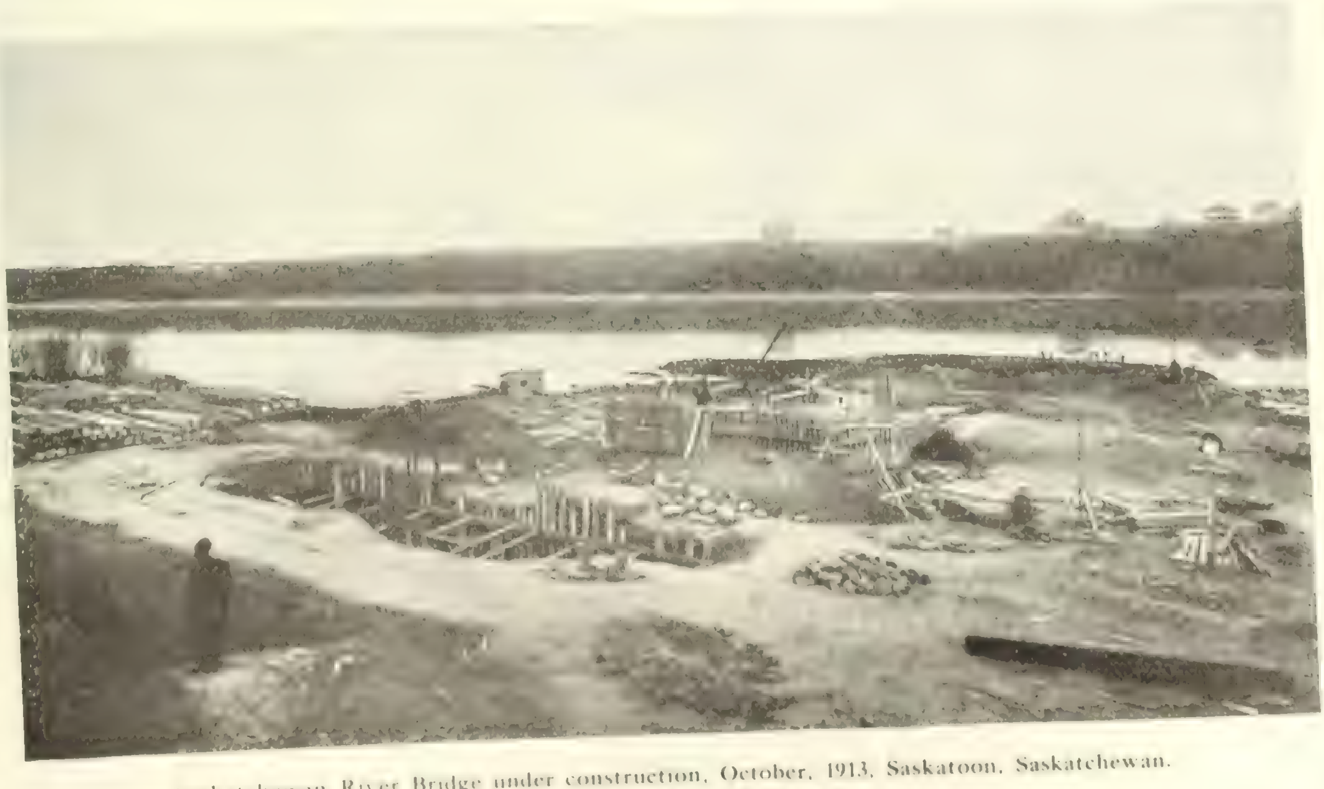
Barrington Bridge under construction, October, 1913, Barrington, Rhode Island.
Five spans of 55 to 60 ft. each.



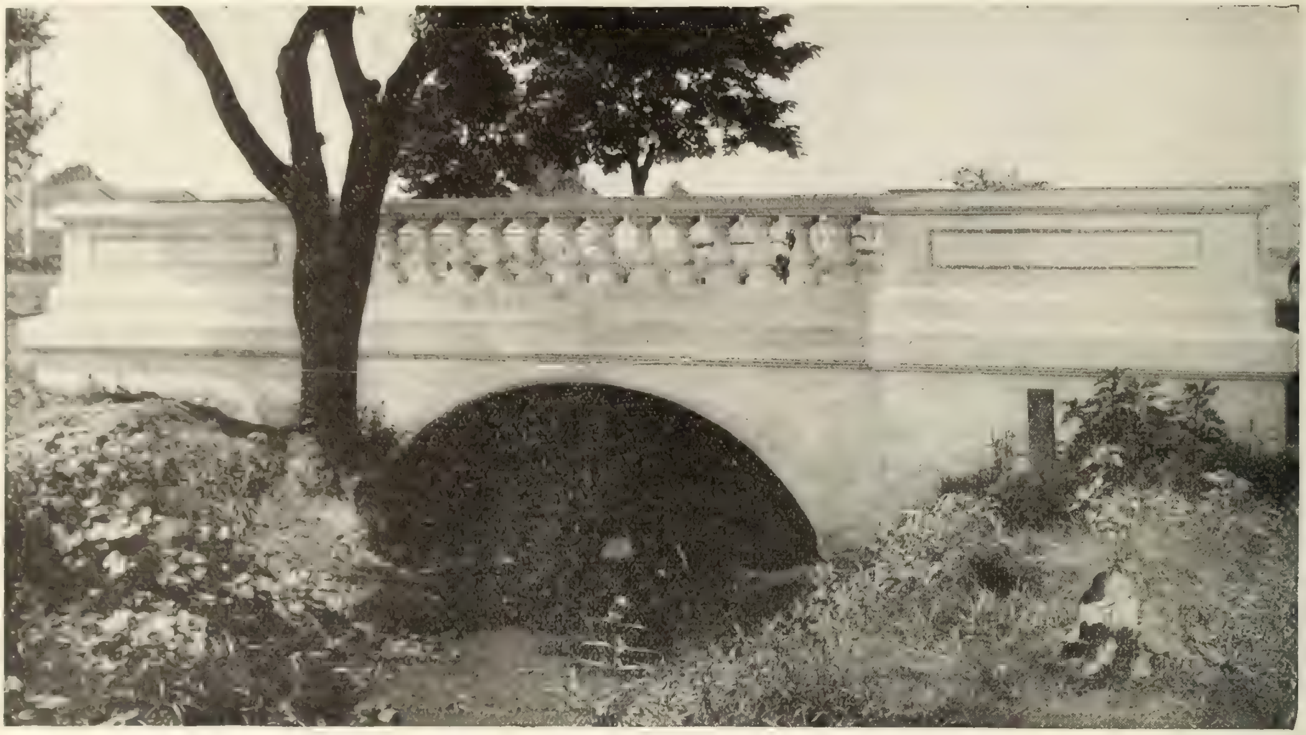
Stony Creek Bridge under construction, October, 1913, Orland, California.
Thirteen spans of 70 to 100 ft. each.



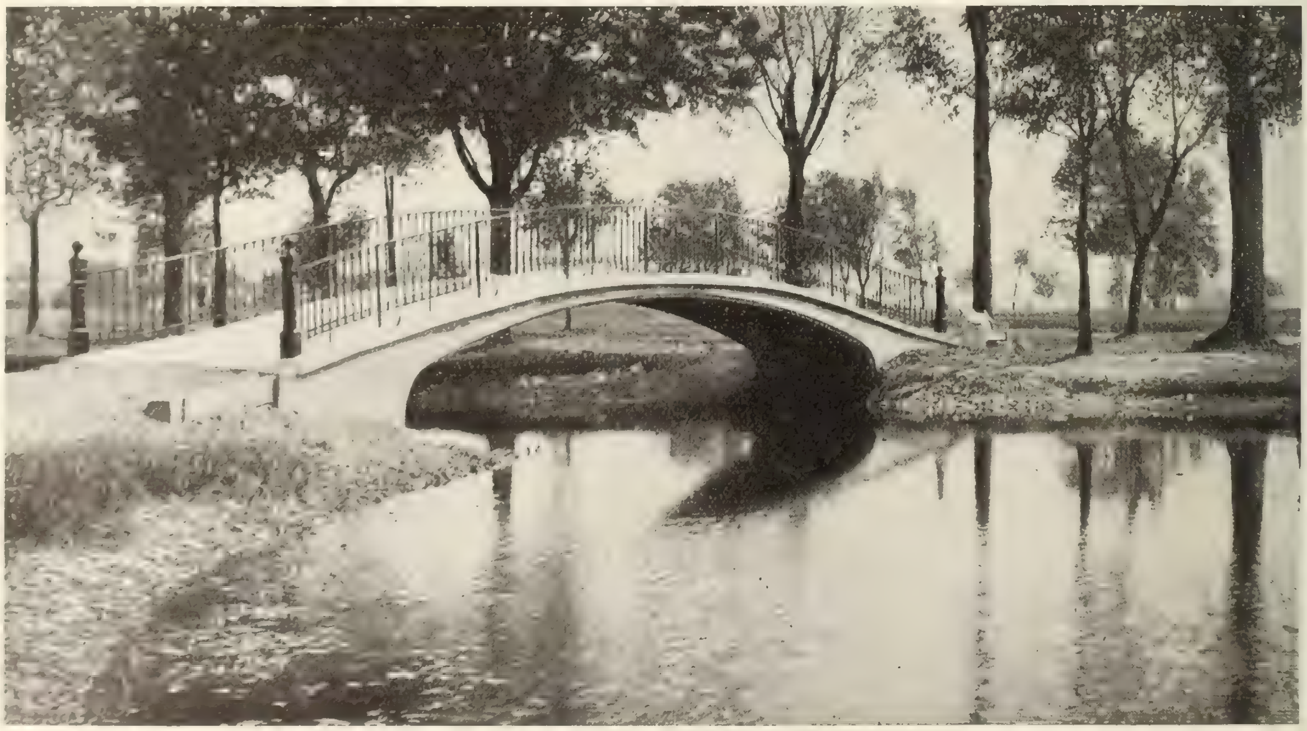
Hillsboro' River Bridge under construction, October, 1913, Tampa, Florida. Three spans of 84 to 93 ft. each.



Saskatchewan River Bridge under construction, October, 1913, Saskatoon, Saskatchewan. Ten spans of 25 to 150 ft. each.



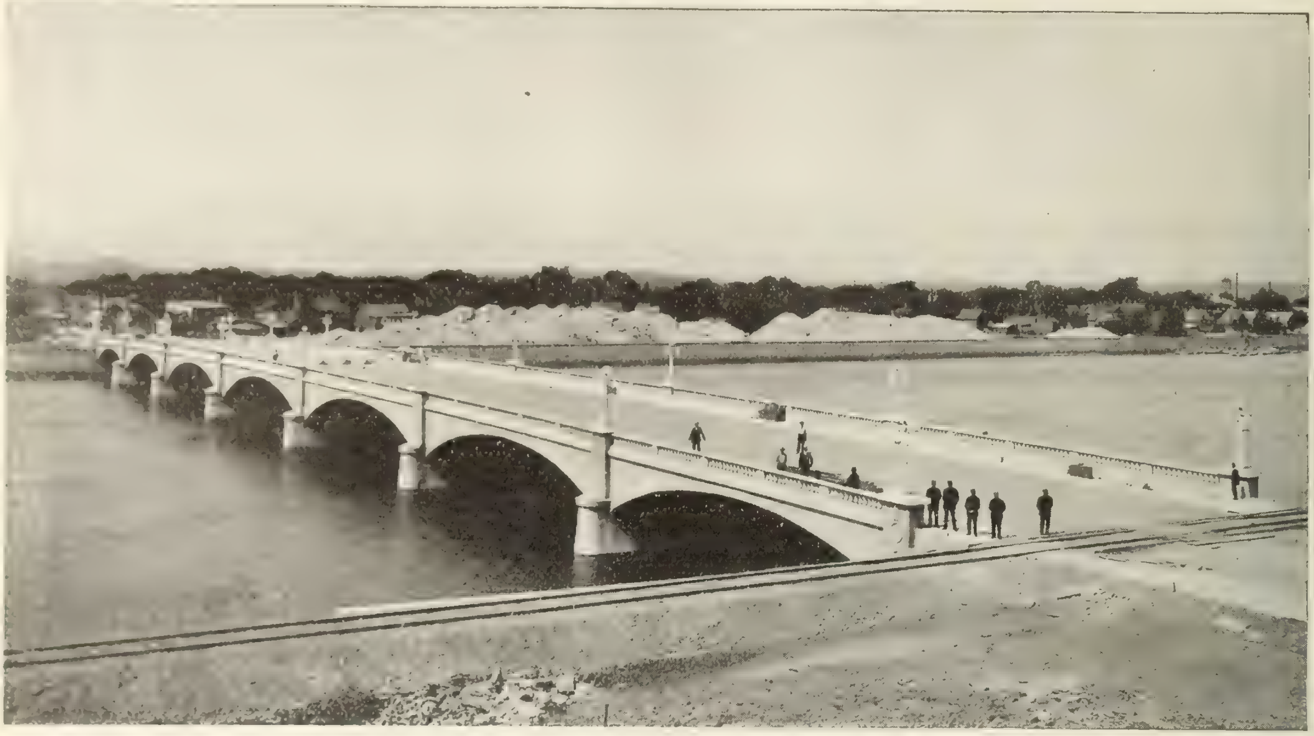
Concrete arch bridge. Des Moines, Iowa.
Span of waterway, 12 ft.



Concrete arch bridge, Columbian Park, Lafayette, Indiana.
Span of waterway, 40 ft.

Concrete arch bridge, Yorktown, Indiana
Span of waterway, 95 ft.

Concrete arch bridge over Maumee River, near Toledo, Ohio.
Twelve spans of 75 to 90 ft. each.



Concrete arch bridge over Grand River, Grand Rapids, Michigan.
Seven spans of 73 to 90-ft. each.

Concrete arch bridge, Lake Forest, Illinois.
Three spans of 45-ft. each.

investment. In the concrete arch bridge the only loss is that of the railings, which would perhaps be restroyed, and the side walls, which would be buried in the new fill. But this would doubtless be more than compensated in general by the fact that with the addition of increased width it is possible to produce a more ornate design than was originally contemplated. For it is usual at first to build even a permanent bridge as cheaply as possible. Hence earlier designs, although they may be dignified, are usually plain and lacking in ornamentation. But as a community grows older and learns to appreciate the beauty of permanent public works, well-designed and properly ornamented, the demand for handsome structures increases until even country highway bridges are surmounted by handsome railings of molded concrete balusters and massive end posts.

The concrete arch bridge thus provides all the qualifications requisite to an absolutely permanent bridge. Moreover, it is one of the handsomest bridges that can be designed and lends itself admirably to harmonious treatment for almost any location. It carries the roadway itself across the stream without any change in the road surface and even competes with temporary bridges in first cost. It is adapted to almost all spans up to 150 feet and by multiplying the spans can be adjusted to almost any location. It is the ideal highway bridge.

Practical Concrete Road Construction

POINTS of value to the concrete-road contractor brought out in a paper presented by C. D. Franks at the recent meeting of the Indiana Engineering Society are that forms for 800 lin. ft. of road will be required to handle the work properly on a 16-ft. road; that from 300 to 500 ft. of 16-ft. pavement can be laid in a day and the work will be delayed if 800 ft. of forms are not available; that the form setters should keep far enough ahead of the mixer so that the subgrade can be checked, and that for a large job it will be economical to protect the top of the forms with a metal strip.

A careful checking of the elevation of the foundation at frequent intervals of, say, 2 or 3 ft. by the use of a straightedge or string, resting on or stretched from the top of the side forms, and a rule is important in order to insure the proper thickness of the finished concrete. This may seem like an unnecessary requirement, but variation of less than 2 in. cannot, or will not, be detected by the eye. Failure to check the foundation as outlined will result in decreasing the thickness of the pavement at the center [illegible] per cent or more where full strength is absolutely essential.

Mixing

The actual mixing of the concrete is of the utmost importance. Frequently, in practice, the time the materials remain in the drum is governed only by the speed of the gang charging the skip. At times the batch mixer is operated practically as a continuous mixer by fastening the discharge scoop or spout so that there is a constant flow of concrete from the mixer. Such a practice is a source of constant controversy between the inspectors of engineers and the contractor. In all cases the drum should be completely emptied before the next skip of material is dumped into the mixer.

Other things being equal, the quality of the concrete is materially improved by thorough mixing. To insure this the speed in revolutions per minute of the mixer and the time the batch remains in the mixer after the water is added should be specified. To specify the one without the other is not sufficient, as is shown by the fact that on fifteen jobs the speed of the mixer varied from 7 to 32 r.p.m. and the time of mixing varied from ten seconds to two minutes, irrespective of the revolutions per minute. The drum speed should be about 16 r.p.m. for a minimum and about 21 for a maximum. The materials should remain in the drum at least three-fourths of a minute, and one minute would be better. Tests have shown that where concrete is mixed less than this time its strength is materially less than where the concrete is mixed three-quarters of a minute or more.

The strike board should always be worked forward about perpendicular to the axis of the roadway, and as it is moved ahead should be sawed back and forth across the road. At least two passages, and sometimes more, of the strike board over the surface will be required to produce a finish of the desired character.

When a concrete road has been laid in the late fall it is frequently difficult to determine when it will be safe to throw the road open to traffic. In some cases it may be necessary to open the road before the engineer in charge feels that it would be absolutely safe to do so. Under such conditions if about 3 in. of straw are placed on the pavement and this covered with several inches of earth the surface of the pavement may be protected sufficiently to allow the opening of the road a week or two sooner than could be safely done without such protection.

In discussing garbage disposal before the Cleveland Engineering Society recently, Mr. C. O. Bartlett stated that he believed his company had nearly perfected an economic system of garbage reduction adaptable to small as well as to large towns. Although not ready to give details, Mr. Bartlett outlined the process, as applicable to a town of, say, 5,000, as follows: Collect the garbage each day and place it in a steam-tight digester before it gets old and decays, and immediately cook or digest it. After digesting, steam press it down to about 50 per cent. moisture in the same digester, taking the water to a settling tank where the grease can be drawn off, saved, and the tank water passed to the sewer. Then dry the steam pressed tankage in the steam dryer down to about 12 per cent. moisture, which can be sold either direct to the farmers or to the manufacturers of commercial fertilizer. This is the simplest and best way that I know of. The principal object is to get the garbage into an absolutely tight receptacle and convert it into commercially salable material.

An action brought against a Montreal woman, Dame Millette, to recover a penalty of $200 for unlawfully practising architecture was dismissed with costs, it having been shown that the lady had not made use of the word "architecture" although she had offered to supply details and plans for a consideration, such details being the equivalent of the ordinary specifications supplied by architects. The offer was made in a printed catalogue and in the advertisements published in the press. In the catalogue it was stated expressly that the firm had no connection with the Association of Architects of the Province of Quebec, hence the failure of the action.

The Special Application of the Various Roofing Materials

THE following data on roofing materials were taken from the report of the Committee on Buildings of the American Railway Engineering Association. In selecting a roofing there should be considered:

(1) Chance of leaks, due to character of construction.

(2) Probable life, including chance of damage by the elements and by wear from other causes.

(3) Fire-resisting value.

(4) Cost of maintenance.

(5) First cost.

The important materials may be classified as follows:

(a) Bituminous substances, applied with felts made of rags, asbestos or jute.

(b) Clay and cement products and slate.

(c) Metals.

As to manner of laying the roofing materials they may be placed in one of two classes: Materials for a flat roof, cemented together, as a coal-tar pitch-and-gravel roof or an ordinary tin roof; and materials for a steep roof, laid shingle fashion.

Bituminous Materials

The common bituminous materials are: Coal-tar pitch (the heavier distillates of bituminous coal); various asphalts (bitumens found naturally in the solid state); various petroleum products; and various animal and vegetable residues. Their peculiar value lies in the fact that they are practically insoluble in water, and that they are elastic, adhesive, and comparatively stable.

Coal-tar pitch is easily affected by heat and cold, is not acted upon at all by water, is easily worked, and, if properly protected, is very stable. It should ordinarily be used as it comes from the still "straight run," of a consistency suitable to the climate and to proper application. **Water-gas tar pitch,** a by-product in the manufacture of water gas, which is enriched by gas from petroleum oils, resembles coal tar. It is inferior to coal tar pitch for roofing purposes, and materials made from it should only be accepted in the low-priced products. It has more value as a saturant of felts than as a coating.

The **asphalts** are unsuitable for use in their natural state. They are ordinarily fluxed with products of petroleum.

The **petroleums** found in this country vary considerably, and grade roughly in quality, according to location from East to West. The California oils, with their asphaltic base, furnish materials especially valuable for roofing. The blowing of air through a heated still of certain petroleum products produces "blown oils," which, while somewhat lacking in adhesive properties, are not easily susceptible to atmospheric changes and are valuable especially for roofing coatings.

A single asphalt fluxed with a single oil is for most purposes a crude and unsatisfactory material. To secure the best results for any desired purpose, several oil and asphaltic substances must ordinarily be compounded. This requires skill and experience. Those properly made are for certain conditions invaluable, particularly for ready roofing, for which tar products are not suited.

The asphalt and petroleum products are not so readily affected by heat and cold as is coal-tar pitch, and lesser amounts of them are necessary to get good results. They are more expensive, require more skill in handling, and, when protected, some at least are to some extent liable to lose their life by drying out of the oil fluxes. Unprotected, they do much better than does coal tar.

Felts

The bituminous substances are used with felts whose qualities considerably affect the roofing. The ordinary felt is made of rags, mainly cotton. "Wool Felt" is a misnomer. Asbestos felts, as compared with the rag felt, act less as a carrying medium for the bitumens, but rather as a protection to the layers of bitumen. They are not suited for use with coal-tar pitch, but are not injured by hot asphalt. They are more expensive than rag felts, but have some peculiar and valuable qualities. Burlap made from jute decays easily when not protected. It is used in a few ready roofings, with rag felts, to increase their tensile strength, the need of which is not generally agreed to.

Built-up Roofs

The bituminous roofings come ready to lay, or can be built up on the roof, using layers of saturated felt mopped with pitch, and properly protected.

The built-up roof is especially valuable for flat surfaces. It can be made as heavy as desired and if properly laid and of good materials it gives a roofing which by long experience has been shown to be economical and efficient. Where the roof is to be subjected to wear and where the character of the construction warrants the expense, flat tiles or bricks should be used as a protective coating to the roofing intsead of gravel or slag.

For the flat roof built under average conditions, coal-tar pitch is recommended in preference to asphalt products. It is more easily handled, requiring less skill, and while more material is necessary it is still cheaper, and in our opinion more certain results can usually be expected from its use when laid by the average contractor. The large amount of material, although heavy, has an insulating value. Good results, however, can be expected from built-up roofs using good asphalt compounds where laid by skilled workmen.

When the slope of the roof is over 3 ins. to the foot, the application of a built-up roof becomes more difficult for both coal-tar and asphalt, it being harder to get even mopping and there is more chance of accident for the men. The desirable straight run coal-tar pitch cannot be used, it being necessary to add some stiffening material which is supposed to affect somewhat the life of the pitch. This must not be done except under supervision skilled in such work, and especial care must also be taken in the selection and application of the stone or slag coating.

Built-up roofs with a ready roofing for the coating sheet are proposed by various manufacturers. They should have their best value for steep slopes.

The advantages of a coal-tar pitch built-up roofing are such that it is recommended where a permanent roof is desired and where the character of the structure allows the building to be so designed as to allow its use. A flat roof makes an economical structure and has small fire hazard. A pitch of from ½-in. to 1-in. to the foot is better than anything steeper. With proper materials and application a life of from 15 to 20 years can be expected with a flat roof.

No contracts should be made for a built-up roof without a complete and positive specification which includes flashings, and the contract prices should not be less than those of the materials specified plus a reasonable amount to cover the cost of laying and profit. Thorough inspection of workmanship and material is recommended.

Ready Roofing

The ready roofing has better value for the steeper roofs than for those of small pitch. It averages much cheaper than the built-up types. Most kinds to get a fair life require occasional recoating. For flat slopes they are hard to lay absolutely tight, and they are not economical for a permanent structure, but on slopes of from 3 ins. to the foot up their use is more justifiable.

Ready or prepared roofings are recommended for use on small, temporary and other buildings, where the cost, considering maintenance, of more expensive roofings is not justified. They are also of value for steep slopes where a built-up coal tar cannot be used, and for locations where the skilled labor necessary for a built-up roof is not available. The steeper the slope the greater their relative value and the wider their economical field. The heavier varieties are in general the more desirable because of their chance for longer life and their greater fire-resisting value. In making selections the reliability of the manufacturer, service tests and the cost should be governing factors.

On the steeper slopes the use of ready roofing shingles properly reinforced so as to prevent curling up at the corner and fraying on the exposed edges and laid shingle-fashion is growing. They are supposed to give better results than the rolled goods, but cost more. They would seem at least to be worthy of investigation.

Slate and Tile

Slate makes a good roof if of good quality and properly watched. It breaks easily and cannot be walked on without danger to the slate.

Tile of good quality gives good results. It is not so tight as slate, but does not break easily. It has architectural value, and its use is growing, with improvement in the product and in the variety of colors.

Slate and tile of suitable quality, properly protected and fastened, can be recommended on roofs with a pitch of 6 ins. to the foot or over, where expense is not the governing feature and where they aid in producing the desired architectural effect, except that where there is much chance of driving snow 8 ins. to the foot should be the flattest slope allowed.

Asbestos Shingles

Shingles of asbestos and Portland cement are of value. They have some elasticity and can be drawn down tight.

Wood Shingles

Wood shingles are not now desirable for a railroad structure.

Cement Tile

Small cement tile are not considered of much value, being brittle. Large cement tiles reinforced, laid without sheathing directly on the purlins are in use on shops and freight houses and seem to have considerable merit. Glass can be introduced into them, thus avoiding the expense of skylights. We are not ready to recommend them for plastered or heating buildings or offices where an occasional slight leak would be disastrous.

Metal Roofings

Metallic roofings with steel as a base are not recommended for general use on permanent buildings. They require continual maintenance.

Galvanizing of steel seems to be well worth the expense. Tests of lead covered steel sheets indicate good results. Large sheets of corrugated galvanized steel can sometimes be used economically where the building is not to be heated.

Small metallic shingles of either copper, tin, galvanized steel plate or specially pure iron are not recommended for general use. They are very light in weight and serve a purpose, particularly in the dry climate of the southwest.

In using metals, every effort should be made to secure those of good quality. The pure irons have value. Their virtues have perhaps been overstated, but they are not expensive, and experience seems to indicate considerable economy by their use as a substitute for wrought-iron and steel.

Copper, lead, zinc and Monel metal are used for roofing, but they are not of value for ordinary railroad structures.

General Comments

In the laying of all roofings thoroughness in the preparation of flashings and work around openings is of vital importance.

To get a satisfactory roof there must be a stable structure, careful attention must be given to the design of gutters, and with some types particularly there must be systematic inspection and regular repairs. In buying a roofing its fire-resisting qualities, to a considerable extent depending on the quantity of material as well as its quality, are of great importance. A building covered with a heavy coal-tar pitch-and-gravel roofing is a better fire risk than one covered with corrugated steel sheets, or with a light ready roofing. The practice of depending merely upon guarantees in selecting roofings cannot be trusted to secure proper results. It does not pay to put a cheap roof on a good building. The annoyance and indirect expense occasioned by leaky and short-lived roofs are rarely compensated for by any possible saving in first cost.

The contract has been awarded to Vancouver Island lumber firms to deliver to the order of the Dominion Government at Toronto 24,000,000 feet of timber to be used in the construction of the new harbor works at that city. Delivery must be completed within four years. A contract of this size is considered large in the lumber business, and the fact that it is the first contract to be placed as a direct result of the opening of the Panama Canal in the current year is taken as an earnest of the vastly increased trade for Vancouver Island to follow from that event.

Desirability of Co-Operation Between Architects and Contractors

By Charles A. Bowen[*]

THERE are many problems confronting the contractors and builders of the present day and while the methods and practices are largely improved from those of a few years ago, yet there are still in existence many of the problems which existed in the past decade which have been brought about by present-day conditions.

Building is one of the unfortunate trades in which an inexpert person is pre-disposed to believe that he knows quite as much as the expert, and while it is a fact that he generally knows what he wants, what he may be entitled to under the contract is often an entirely different matter and in this condition often lies the opportunity for arguments. As has been stated in previous articles, poor plans and specifications frequently handed the contractor upon which to bid for his work is a large problem, as is likewise a lack of skilled labor. Even these might be overcome if there was not such a lack of co-operation between architects and contractors.

The Lack of Co-Operation

This, it seems to me, is the largest problem which confronts those who are engaged in the contracting and building business to-day. There is no reason why there should be such a lack of co-operation between the architect and the contractor, for the source of their business and its existence is absolutely the same. The architect must have the contractor and the contractor, in most cases, must have the architect, while the work of each parallels that of the other. They are constantly in contact and the problems which confront the one, usually, are the problems which confront the other, and yet for some reason there is a woeful lack of co-operation between the two.

The architect is apparently imbued with the idea that the contractor is going to get the best of him and the contractor, on the other hand, seems to be imbued with the idea that the architect is trying to "put one over" on him, and instead of being upon a friendly basis where they can work in the greatest harmony to the best interests of their clients they are apparently, more or less, at swords' points. Whether this is the result of some peculiar make-up in the nature of the two, one being an artist and the other a mechanic, whether it is due to a lack of education along lines of compatability, or whether it is due to the condition of the time in which we live, it is nevertheless a most deplorable fact that this lack of co-operation exists.

There is, of course, unfair competition among and between architects as well as unfair competition among and between contractors, which is a great drawback to both of these important lines of a business which is one of the foremost of our modern times, and there is a large amount of unfair criticism by the general public against both contractor and architect which is entirely superficial and without foundation or sense. Yet it is thought by some of both profession and craft that a closer affiliation with each other would only strengthen in the minds of the public, the basis of this unfair criticism, that there was a collusion between them.

An Absurd Proposition

How absolutely absurd such a proposition or thought is may be seen in almost every building project, where this very lack of co-operation is shown by the troubles which arise, the disputes which have to be settled, the changes in specifications which have to be made, the large amount of "extras" which are necessary and for which the owner is held up on the work and which makes the cost more than originally intended or estimated.

Would it not be better to set aside public opinion which is as variable as the wind, and have closer affiliation between architect and contractor, so that these troubles and abuses might be overcome through conference and friendliness and the exchange of ideas and thoughts, and thus prove in a few short months that it was a most beneficial association in that better and more complete plans and specifications would be made, more understandable and equitable contracts drawn, better building done and at a lesser cost, and with less worry to the owner who is paying the bills, the architect who has drawn the plans and made the specifications and the contractor who is executing the work. I contend that it would, and I also contend that men brought in contact with each other in such a manner are more fair, more honest, more sincere and more considerate of each other, and that they do not stoop to underhanded methods or illegal or unfair combinations and collusions—in other words, are honest business men at peace with each other and the world.

Close Sympathy Between Architect and Builder

This is a day of co-operation; it is bringing about better results in every line of business and increasing individual efficiency. In a business of such importance as the building industry the closest sympathy and co-operation should exist between architect and contractor, who are both in the employ of the owner, to bring about the best results, not only for that owner who is pre-eminently entitled to it because he is paying for it, but for the benefit of the general public, the stability and beauty of our cities and villages and the general prosperity and solidity of our country.

Removing anchor ice from an intake pipe line of the waterworks at Moline, Ill., is accomplished by means of air, which is furnished by a Roots blower used in the washing of the rapid filters, according to a paper recently presented to the Illinois Water Supply Association by L. A. Fritze, chemist of the Moline Water Department. A 2½-in. pipe from the blower is tapped into the inner end of the 300-ft. length of a cast-iron intake line extending into the river. Ordinarily, a pressure of 10 lb. is used for the filters, but as high as 30 lb. are used to loosen the ice, which seems to collect around the unprotected end of the pipe and on the inside of it. The slight increase in temperature and the impact of the air were given as probable reasons for the successful clearing of the line.

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[*] Secretary Detroit Builders' Exchange.

Technical and Economical Aspects of Road-Building in Quebec[*]

By Gabriel Henry[†]

IN this paper two of the principal aspects of the question of roads, the technical and the economical, will constantly be referred to. In the opinion of the author no sane conclusion can be arrived at without considering the question under the two principal aspects above mentioned.

The technical part is very important indeed, especially in new countries, but many millions have been wasted by neglecting the economics of road building. In the Province of Quebec for a long time, on account of its population being agricultural, and, at first scattered over a large territory, the question of a systematic improvement of roads was not an important consideration, each farmer maintaining, or rather being supposed to maintain, the portion of the road fronting his lot and some portions of the near by-roads. Of course at a certain distance from villages and cities there was no traffic worthy of mention.

It was only near the cities, where roads were badly cut up by the waggons of farmers coming to market, that the need of improvement was felt and turnpike roads were constructed. Until some years ago, this state of things had been the almost general rule in this Province, the farmers evidently not being much inconvenienced by it.

The growth of the population, its concentration in the cities, the advent of the railroads, the development of industry and the building of mills and factories even in the remote rural districts at last began to heavily tax the primeval roads of the country, and in many parts of the Province the population began to feel that something should be done for the improvement of highways. The advent of automobiles was the last blow to the indifference of the population in this matter.

Now, the problem to be solved is very difficult. The cost of construction, of improvement and of maintenance of roads is increasing every day and the construction of only the most needed highways will be a heavy burden on the population.

Classification of Roads

In the Province there are some 45,000 miles of roads and of "so-called roads." The "so-called roads," which in this paper will be considered as of the fifth class, are roads which have been opened in sparsely settled districts or remote parts of municipalities for the convenience of settlers. There is a considerable mileage of such roads in the Province, but the traffic over them is not worthy of mention. They require only a rough treatment as in the first days of the colony, and, in fact, are generally not maintained at all, the settlers nearby working form time to time on the worst parts in order to keep them open.

Next come the fourth class of roads and by-roads. The traffic on these roads is light as they are only used by the farmers living along them or in the neighbouring ranges, and they might be considered as second order arteries leading to the more important ones. They should be designated by the expression "county roads," because for a long time to come they will not need a special surfacing and their maintenance as earth roads on account of their light traffic is preferable from the economical point of view. They only need to be graded, put in shape and maintained with split log drags. By means of them the farmers can communicate with the more important roads. The grading of these roads is, in numerous cases, beyond the farmer's means, being too costly. The author here is only making a rough classification of roads in order to render the following explanations easily understood.

Then come the third class roads, that is, roads with such a traffic that they are only maintained at great cost if a special surfacing is not provided. Generally, the waterbound macadam is sufficient and, automobile traffic being in fact light on such roads, other more costly surfacing would, all things considered, not be adapted to these cases. In this class are included portions of roads in the towns and villages where traffic is concentrated, parts of roads leading to railway stations, wharves and mills, or connecting some villages or towns outside of the provincial roads, and also some parts less frequented in the vicinity of cities.

Next, come the highways, properly so-called, which are known in this Province under the name of "provincial roads." They connect cities, or are important arteries leading to the United States, or following tracks along which industrial and commercial activities are concentrated and operated, or leading to the touring districts. These roads generally need special and more costly surfacing, if the economical point of view is considered, on account of the heavy traffic they actually bear or are supposed to have to bear in a near future, and, above all, because they are or will be much frequented by automobiles.

The last class of roads to be considered should be called "trunk roads." In the vicinity of the great cities many important roads of the above mentioned class meet at a certain distance, sometimes some miles from the heart of the cities. From these points to the cities run "trunk roads." These roads usually require to be widened and to have a special treatment of the substructure, a solid foundation and special surfacing, owing to the heavy traffic of steel tired waggons, automobiles, motor trucks, etc., to which they are generally subjected. It would be easy to prepare a list of the roads which, in this Province, have or will have in a near future what is needed in order to classify them as provincial roads, economically speaking.

Provincial Roads

The following list prepared by the author for the occasion is merely a general list of the roads which seem to meet some of the requisites of a provincial road. In this list they do not follow one another in accordance with their importance.

1. King Edward VII. Boulevard (constructed).

2. Montreal-Quebec road, via north shore (under construction).

3. Quebec-Matapedia road along the south shore of the St. Lawrence, via Montmagny, Fraserville, Rimouski, Sayabeck, St. Pierre-du-Lac, and along the Matapedia river to Matapedia and the interprovincial bridge between the Provinces of Quebec and of New Brunswick. This road would be very attractive to tourists.

4. The Montreal-Quebec road on the south shore, via Boucherville, Sorel, Nicolet and Levis. This road will be difficult of construction on account of the steep gullies it crosses along the St. Lawrence.

5. The Montreal-Ottawa road on the north shore, via Ste. Rose, Ste. Therese, Ste. Scholastique, Montebello, Pa

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[*] Paper delivered before the Canadian Society of Civil Engineers in Montreal, on [illegible]

[†] Chief Engineer of the Department of Highways for Quebec.

[illegible]ville, Buckingham, Hull and Ottawa. This road will require a great deal of expropriation.

6. The Montreal-Ottawa road, via Ste. Anne-de-Bellevue, Vaudreuil and Riguard, along the Ottawa river. The greater portion of this road is in the Province of Ontario.

7. The Montreal-Toronto road via Ste. Anne-du-Bellevue, Vaudreuil, Les Cedres, Coteau Landing, St. Zotique, [illegible] Beaudet, along the St. Lawrence, with a branch leading to Valleyfield.

8. The road from Montreal to Malone, U.S., via Laprairie, Caughnawaga, Chateauguay, along the Chateauguay river to Huntingdon, and from that town to the frontier.

9. The Montreal-Sherbrooke road, via St. Lambert, Longueuil, St. Hubert, Chambly, Marieville, St. Cesaire, Abbotsford, Granby, Waterloo, Eastman, Magog and Sherbrooke.

10. A road from Montreal to Richford, U.S., via the foregoing to Chambly, and from Chambly to St. Johns, and probably Farnham or Bedford, Stanbridge, Abbots' Corner and the frontier. The location of this road will probably be difficult on account of the many municipalities wanting it.

11. The Montreal-Sherbrooke road, via Chambly, St. Cesaire, St. Hyacinthe, Ste. Rosalie, Upton, Acton Vale, Richmond, Windsor Mills and Sherbrooke.

12. The Montreal-Quebec road via Richmond, leaving the preceding one at Richmond and running via Danville, Warwick, Arthabaska, Plessisville and Levis.

13. The Quebec-Levis-Jackman U.S. road, via St. Henri, St. Isidore, Scott and along the Chaudiere river, via Ste. Marie, St. Joseph, Beauceville, St. Georges, St. Come, St. Theophile and the frontier. This road is to be constructed next summer.

14. The Sherbrooke-Quebec road, via East Angus, Dudswell, Marbleton, Weedon, Garthby, d'Israeli, and in the Asbestos Mines district, via Coleraine, Black Lake, Thetford Mines, Broughton, St. Frederic and meeting the Quebec-Jackman road at St. Joseph.

15. The Sherbrooke-Quebec road leaving the above-mentioned Sherbrooke-Quebec road at Marbleton and going to Quebec, via the old Craig's road, across the counties of Wolfe and Megantic.

16. The Sherbrooke-Derby Line U.S. road, via Lennoxville and Massawipi. This road will be constructed next summer.

Some exterior belt roads should also be mentioned, such as the road along the Canadian Northern, via L'Assomption, Joliette, Shawinigan, Grade Mere, Riviere a Pierre, St. Raymond and Quebec, and the road from Lacolle to Sherbrooke, via Henryville, Bedford, Stanbridge, Cowansville, Knowlton, Eastman, Magog and Sherbrooke. Certain cross roads between the principal provincial roads should be noted, such as a road between St. Hyacinthe and Sorel; Arthabaska and Three Rivers; Three Rivers and Shawinigan; Marbleton and Danville, via Asbestos Mines, Co. Richmond, etc. There are likewise some other roads, such as the belt road around the Gaspe Peninsula, the road between Quebec and Murray Bay, on the north shore, via St. Anne-de-Beaupre, St. Joachim, St. Tite, Baie St. Paul, Less Eboulements, St. Irenee, Murray Bay to Chicoutimi, via Ste. Anges, from Chicoutimi to Lake St. John and a belt line around Lake St. John. A road should also be constructed to the north of Montreal, via St. Jerome and Ste. Agathe to Mount Laurier. As examples of trunk roads may be mentioned the Chambly-Montreal, which is to receive the traffic of the two Montreal-Sherbrooke and of the Montreal-Richford roads; the Montreal-Ste. Anne-de-Bellevue, which is to receive the traffic of the Montreal-Ottawa and of the Montreal-Toronto roads; the Sherbrooke-Marbleton and the Montreal-L'Assomption roads.

In the opinion of the author the cost of such a system, the mileage of which is very considerable, would be so high and would so heavily tax the resources of the Province that the present generation cannot hope to see it completed, and the population of the Province of Quebec will have to wait many years before this system becomes justifiable and financially possible through the development of the country. It is hoped, however, that the roads most needed will be constructed in a few years.

The question which arises now is how and where to proceed in the improvement of the system of roads of the Province. The outlay will be very heavy and the monetary resources are comparatively limited. On the one hand the farmers from every part of the Province are asking for improvements of their roads which are much needed and are beyond their means. Everywhere are hills to be turned in order to improve impracticable and dangerous grades; low-lying places to be raised to avoid floods, which cause a great many roads to be impassable not only in the spring but frequently many times a year and do great damage to road beds; rocks to be mined, and bridges to be constructed; all improvements beyond the means of the municipalities, and a townsman can satisfy himself on that score by making a trip in the spring even to rural districts not far remote from cities. On the other hand automobilists are calling for provincial highways. To many the progress of the Province lies in the development of the latter kind of costly highways, the farmer's needs being set aside, or rather, ignored.

No thought is given by the public to the cost of maintaining roads. In the author's opinion the following should first be considered under such circumstances:—An outlay, which must be a paying investment should be made by the community. In order to obtain this not only the first cost of the improvement must be considered but the funds so invested must be protected from loss by waste and decay. The conclusions to be drawn from this are:—1. That no road should be improved without some provision for the maintenance of such road. 2. That all unprofitable work and works "de luxe" should be avoided within certain limits. 3. That all improvements not actually and positively needed should be omitted or postponed. As examples of such improvements the author may cite the adoption of costly surfacing for portions of roads where the traffic provided for will come at a later period, and all other unwise selections of surfacing either with a view to economize on the first cost or to display some luxury. 4. That the choice of some kind of pavement, the durability and ease of maintenance of which has not been ascertained in practice, be avoided as much as possible. 5. That unnecessary experiments be avoided. It is better to profit by experience obtained elsewhere and to make only those experiments which are absolutely necessary for adapting some good recognised product, process or method to local conditions.

Again, as the improvement of roads, like industrial or commercial investments, has to be a paying one, the sum invested should, in the author's opinion, be divided into three parts: one to be set aside for work which does not decay and can be easily and cheaply maintained without loss of value and for which a depreciation fund is to be provided; and a maintenance fund for annual repairs.

In the case of a macadamized road, for example, the cost of the earthwork, of the drainage and underdrainage and of the foundation should be considered as belonging to the first class, the cost of the surfacing to the second class, and to the third class the money required annually for maintenance.

Again, in the opinion of the author, there should be no hesitation in spending money judiciously and when needed for earthworks, underdrainage, ditches, substantial, well designed and well constructed concrete bridges and culverts, and good and appropriate foundations.

All money so expended adds value to the country, prepares roads for the surfacing, even when the latter is to be laid later, and is remunerative. Such kind of work well planned and well made lasts a very long time and requires little money annually for maintenance. On the other hand it is a waste of money to use costly wearing coats on a substructure not well drained or a water bound macadam on hills with a 10 per cent. slope.

How to Begin Improvements

Further, the author's impression is that the improvement of the roads of the Province of Quebec should be begun by preparing the substructure, lowering grades or rounding up hills, draining surface waters and underdraining ground waters, constructing bridges, straightening unnecessarily tortuous roads, maintaining these improved substructures as earth or gravel roads as the case may be pending the next step of the improvement, and the laying of surfacing. All this can be done economically. Surfacing should be used only when and where necessary. This mode of procedure would have a great advantage which is worth being insisted upon. Laying wearing coats on new fills not sufficiently settled, or on a new soil not sufficiently trampled by traffic nor well seasoned, accounts for many failures of good surfacings and for expenses of maintenance greatly exceeding the provisions. Quick work in road-making is not always to be recommended.

When the substructure of a road has been prepared and the foundation laid in advance, inconvenience is to be feared. Another occasional advantage is to divide the work. Contractors specialising in earthworks sometimes are not well acquainted with the laying of wearing coats, or have not at their disposal the skilled workmen required for such work, and the reverse is the case for surfacing contractors.

The author does not advocate the spending at present of all available money in preparing substructures of rural roads. Provincial roads are badly needed and for these the work must be pushed quickly; but stress must be laid on the advisability in many cases of preparing the substructure of roads in advance, and on the inconvenience of laying surfacing on improper and unseasoned substructures. There is no standard cross section for substructures of roads, but details should be standardized in accordance with the results furnished by experience. The width of 24 feet between ditches is not too great, but just what is needed for two wide automobiles or two hay waggons to cross each other, or a hay waggon to cross a wide automobile; for such cases plenty of room should be provided. It would be better to widen than to narrow the roads. When a horse vehicle meets an automobile, if the horses are nervous and deep ditches run alongside the road a traveller often feels that 24 feet is not too wide. This width should be reduced only in roads of secondary importance or when called for by special conditions. Even for roads much less important than provincial roads this width should be adopted if an increase of traffic is foreseen in the near future. In trunk roads the width between ditches may be increased if necessary to 32 feet or more and should never be less than 24 feet.

On embankments the platform should receive an additional width of 3 feet and have a total width of at least 27 feet from edge to edge, because the back of the guard-rail posts should be set at least one foot from the edge of the embankment. In cuts, generally no ditches are needed and gutters prevail; consequently, the total width of the platform at the bottom of the cut can usually be reduced to between 26 and 28 feet for a 24 foot wide road. The edges of the embankments should be bevelled or rounded when the engineer has to deal with a clay soil, in which case it is useless to try to get sharp edges. The slopes along the embankments and cut should generally be 1½ horizontal to 1 vertical, but engineers may avail themselves of the nature of the soil if well acquainted with the natural slope of one particular soil. In this country it is necessary to avoid cuts on account of the snow, which, in winter, fills them and renders the road impracticable.

If the road is to receive its surfacing later, it should be given a transversal crown of at least 1 inch in the foot in order to shed the rain-water into the ditches and to allow maintenance with split-log drags. If the road is to immediately receive its surfacing, shoulders at least 4 feet wide should be provided. The slope of these shoulders towards the ditches should be at least 1½ inch to the foot.

Such are the principal features of a cross section of the substructure.

For the execution of the earthwork the same rules are to be followed as in the case of railways. For shrinkage the rates of fills to cuts comprise between 1.15 and 1.30—1.15 being for heavy work and 1.30 for light skimming work.

The Rolling Grade System

In the author's opinion the rolling grade system with vertical curves should be adopted, because it is more economical and facilitates the drainage of the substructure. It is useless to try to get at great cost long stretches of horizontal road. The maximum ruling grade should not be more than 5 per cent. whenever possible, 6 per cent. and 7 per cent. grades being resorted to only in short patches when absolutely imposed by necessity. A waterbound macadam is maintained only at great cost in this country on grades of 7 per cent. and more, and on account of the snow filling the ditches in the spring, water from melting snow, in many places, injures the roads. The same holds for earth or gravel roads. It is better to try to get 5 per cent. by turning around hills when improving a road than by cutting them too much. Minimum grades should not be less than 0.6 per cent. to ensure the longitudinal drainage of the road.

Curves having a radius less than 300 feet should be avoided in steep grades and at the foot of such grades, and a radius less than 200 feet should always be avoided even in flat stretch. When it is necessary to adopt a radius less than 200 feet, the road should be widened in the curve and be given a transversal slope towards the centre of about 1 inch to the foot.

The end or the beginning of a slope should not be found at a distance less than 50 feet from a level crossing of a railway or from the end of a bridge. Sight distance in horizontal or vertical curves should be at least 300 feet, depending in each case on the conditions. Near a railroad crossing the sight distance on each side in the direction of the track should be at least 3,000 feet.

In every case, the economy of grading should not be the controlling factor. The most important considerations should always be kept in mind in determining the profile and the cross sections. The standards can be used as general guides, but good common sense and acquaintance with local conditions should have much to do with it.

The earthworks are computed as for railways, but for roads greater exactitude is needed because in this case they consist chiefly of skimming work, ditching and shouldering, which cost more per cubic yard and are more difficult to estimate exactly.

Draining Soil Important

The draining of the soil is the most important thing in road construction, because the bearing power of the soil depends upon the moisture it contains. In this country this question is far more important than in the southern countries, owing to the nature of the climate.

The soil is soaked by rain-water and by ground-water. The rain-water should be disposed of as quickly as possible by a good, substantial system of ditches, gutters and culverts. Deep ditches should be avoided as much as possible and gutters substituted. Deep [illegible] along flat stretches of road in order to get the necessary slope to cause a quick and complete drainage of water. The minimum slope to be given to ditches should be 5 inches in 100 feet. Stagnant water should never be found in a ditch.

The greater slope depends upon the resisting power of the soil to abrasion by water and should never exceed such power.

The slopes of the sides of the ditches should be regular and as nearly as possible 1½ foot horizontal to 1 foot vertical. It is very difficult to attain this in a flat country where ditches have sometimes to be very deep and wide and would exceed the portion of the right of way that it is possible to set apart for them. In such cases rip-raps have to be resorted to. Gutters along hills should be paved with cobble stones whenever the soil is not hard enough to resist abrasion by running water.

Tile underdrainage with good outlets is generally to be preferred to deep ditches for disposing of the ground water. Road underdrainage should be made in the same way as in the case of field drainage. Tiles should be laid under the sides of the road rather than under the centre, and should be disposed so as to intercept all water coming from the neighbouring fields before they enter the right of way. It is important that good and frequent outlets should be provided. Underdrainage, in order to be a permanent and useful work, should be done with the greatest care. It is very difficult to drain a road effectively and completely, and in many cases it is impossible to get the ground water out. Generally, although the soil is dry, its bearing power is not great enough to stand concentrated wheel loads and it is impracticable to sufficiently consolidate it; sometimes a sufficient and effective underdrainage is impossible, and then it is necessary to resort to the use of a foundation in order to distribute the concentrated wheel loads over a wider surface.

The Foundation

The foundation plays the same role in the case of roads as ballast in the case of railways. It is generally assumed that the downward pressure follows a line at an angle of 45 deg. from the horizontal and is distributed over an area equal to the square of twice the depth of the total thickness of the surfacing and of the foundation. This is merely an assumption but it is approximate enough in practice, and it has been found that the thickness of the foundation plus the thickness of the surfacing should not be less than 9 inches in common soil for steel tire traffic.

A non-porous soil drained of ground water will support a load of about 4 pounds to the square inch, that is, about 1,300 pounds per square inch applied to the surface of a coating 9 inches thick, per lineal inch of waggon tire. In practice a load of 700 to 800 lbs. per lineal inch of tire is assumed, that is, 2 to 2½ inches per square inch on the substructure with a 9-inch thick surfacing including the thickness of the foundation.

Many good surfacings give bad results owing to the lack of a substantial foundation. For a soft tire traffic a foundation is not so necessary as for the traffic of waggons with narrow tires and without springs, the impact of which is very damaging to roads.

The foundation should be composed of stones not larger than 4 inches, and a filler in the voids is to be recommended whenever it is not very expensive. Gravel, as in the case of the railways, gives a good foundation and is even better than stone. Telford foundation should be resorted to only in case of necessity. Flat stones should not be used.

Foundations are of the class of permanent works mentioned above. Bridges and culverts should also be so constructed as to be considered worthy of the same class.

Good concrete is well adapted for this kind of work. Concrete pipes should not be used in naturally wet clay soils, especially under heavy embankments. They should be of ordinary thickness and of a diameter not larger than 30 inches under embankments higher than 14 feet. In these two cases box culverts would be preferable. Sand cushions should be employed to protect them against rock. It is absolutely necessary to give the head walls a firm seat, especially in clay soils and when the pipes are under an embankment. Concrete slab bridges are very useful as well as concrete girder bridges. The maximum economical span of a slab bridge is about 15 feet and of a girder bridge between 15 and 30 feet or more. Under high embankments arch culverts should be used.

Concrete trestle bridges are especially recommended for use on rivers where numerous deep gullies are found, as this type of bridge spans them very economically and artistically, thus dispensing with heavy embankments and deep cuts. The latter ought always to be avoided in this country on account of snow.

Many difficulties are encountered in this Province, as elsewhere, in fixing the dimensions of the culverts because the road engineer has, when deciding, to deal with the farmers. The same difficulties are met with when straightening tortuous, crooked roads and improving curves. These difficulties are not technical but are of common occurrence in all countries, being unpleasant and unavoidable. The greatest care should be taken in the planning and construction of bridges and culverts for which the same general rules have to be followed as in the case of railways and of first class concrete work.

The cost of the permanent work, that is, of the part of the outlay permanently invested in the case of roads, is a smaller fraction of the total cost than is generally supposed. Except in special cases, it never exceeds one quarter or one third of the cost of the surfacing proper, and in the case of special wearing coats this proportion is still smaller; consequently, great care should be taken in the choice and the laying of this part of the road which is short lived and so expensive.

Some Points to Consider

The following points should be taken into consideration when making a choice:—

1. Not to attempt to risk surfacings on a substructure which is not sufficiently firm with or without foundation. Waterbound is not excepted.

2. Not to use surfacing in places where floods or other causes could damage same.

3. Not to use costly surfacing when a less costly could reasonably do as well for the number of years the latter is supposed to last.

4. Not to use costly surfacing when the amount of the total sum of the first cost of the sinking fund and of the maintenance of the said surfacing is higher than with a less costly wearing coat which would do as well.

(Concluded in next issue.)

The City Council of Fredericton, N.B., appear to be undecided as to whether they will engage an engineer, notwithstanding the recommendation made some time ago by Mr. F. A. Barbour, consulting engineer, that for the filtration plant an engineer who is thoroughly familiar with the work should be placed in charge. Three applications have been received for the position but the matter of appointment has been deferred for the present.

Two men were killed, one fatally and five seriously injured by the collapse of the west wall of the Independent Cloak Company's building, Toronto, which was burned down a short time ago. All the victims were workmen who had been inside the building clearing away the debris.

LETTERS

"Fish of One Contractor, Flesh of Another"

Editor Contract Record:

I am heartily in accord with your article, "The Curtain Raised on Toronto's Fire Tragedy," published in your issue of April 8, but feel, with others, like saying, "What's the use?"

It is a well-known fact that the recent investigation into the Toronto City Architect's Department was not brought about by the desire of the city council to make an improvement but because of a disagreement between certain factions in the council over the appointment of a City Architect.

All the points brought out at the investigation have been known to many citizens for years. During that period, while few have had any grievance against individuals in the Department, collectively it might be compared to a ship without a rudder.

The many improvements and suggestions that have been made by the Bureau of Municipal Research have been opposed by the civic employees, and those in high authority have rushed to the defence of the heads of the department.

As to the excessive requirements contained in some sections of the building code, personally I do not advise reducing the factor of safety, particularly in these days of "Safety First," but would demand that all classes of builders be compelled to live up to the by-laws, and not make fish of one and flesh of another.

Time and again it has been shown that certain persons, with what is commonly called "pull," can get away with a class of construction that the less fortunate one could not attempt. Even the civic employees break the city by-laws. Recently, to my knowledge, the city demolished a building which belonged to them without erecting a hoarding. Simply a rope was tied from pole to pole and a man placed on guard to warn the people to walk in the middle of the road—which, by the way, has car tracks—thereby endangering the pedestrians' lives. Any contractor would be glad to save fifty dollars, the possible cost of a hoarding, but he would probably end in the Police Court.

Yours truly,

Contractor

"The Time Is Ripe"

Editor Contract Record:

Having read with interest the report of Judge Denton upon the Toronto City Architect's Department, I take pleasure in adding a few words of commendation on the manner in which the "Contract Record" has undertaken to enlighten the public regarding the true conditions of the way in which work has been handled under the City Architect's Department.

That discrimination has been rife is the experience of all who have had dealings with the Department. This discrimination, or to put it in a milder form, this lack of uniformity in handling the work, led to the organization of the Citizens' Committee, whose object was to prepare a by-law which would be up-to-date and to which all would be made to conform.

That the old by-law was faulty and rotten to the core was acknowledged by all, and in many instances the interpretation was worse than the by-law. So strongly was this felt by architects, engineers, contractors, the Board of Trade, the Canadian Manufacturers' Association and others, that a committee was organized and sub-committees composed of members of each of the above-named bodies were appointed. These sub-committees devoted two and three nights a week for a period of some four months to a perusal of the old by-law, correcting and replacing the faulty and obsolete portions. After the various sub-committees were satisfied with their revisions many joint meetings of the committee as a whole were held and the entire by-law was discussed many times, this resulting in the Memorial as presented by the Citizens' Committee to the Council.

The result of this general agitation led to a new by-law being issued, which, while not conforming in all points to the Memorial presented, was a decided improvement over the old one, and would be much better if it were carried out, instead of exceptions being made either by the influence of the Controllers, the Board of Control, the Fire and Light Committee or by the Department itself.

That the time has come for all plans to be examined by men specially qualified in each case to deal with the specific types of construction and that all inspectors of construction should be the best men obtainable is evident. In the writer's opinion the complete organization of a new department under a capable head, with a staff qualified in the branches to which they are assigned, is a necessity.

Should there be organized such a Department, having full jurisdiction over all plans, permits, etc., and whose decision would in all cases be final, with no appeal to the Council or Committees, not only would the safety of the public be protected but all plans would be dealt with on their merits and not according to the influence which might be brought to bear from the powers above. If a change is to take place I say that the time is ripe.

Yours truly,

T. Harry Mace.

The Organization of Engineering

A letter relating to the above topic, discussed editorially in the Contract Record of March 4th, was received from Mr. R. W. Macintyre, M. Can. Soc. C. E.,* and published in our issue of April 1st. Mr. Macintyre's letter was a particularly able presentation of the views accruing from a ripe experience of engineering work, and we regret to find that owing to a printer's error a line was omitted in the final paragraph of the communication. The concluding lines should have been expressed thus:—

> "I can only say, in conclusion, that we must break loose from the 'mutual admiration attitude' mentioned by Mr. Shenton in his address upon which your editorial was based. This attitude is sapping the vitality of our progress. We must be prepared to take and give the hard knocks which always accompany genuine reformation."

In his letter, Mr. Macintyre attributed the present lack of cohesion in the engineering profession to the apathy of the rank and file and the defective organization of the Canadian Society of Civil Engineers.

In a further communication Mr. Macintyre offers the following supplementary observations, which offer food for careful reflection.

"Too frequently one is met by excuses in place of action and I am confirmed in my view that the 'individual equation' forms the keystone of all potential reform.

"'Close corporation' will never effect a remedy, as it affords a shield behind which the incompetent can enjoy security with the competent member, and, like most other forms of protection often has the effect of [illegible]

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*Secretary, Victoria Branch Canadian Society of Civil Engineers.

[illegible] at the expense of the community, by 'sandbagging the stimulus of legitimate competition.

The close corporation granted to other professions does not always guarantee satisfactory results to the public when employing professional service, and we again revolve to the starting point, of individual ability selected from personal experience and judgment.

"It must be borne in mind, however, that a certain section of the public consider the cost rather than the quality of professional service paramount, and this is where the cheap man gets his foothold. This phase of the question being beyond legislation resolves itself into a matter of education.

"If every practising engineer had to be registered with the government and registration were made consistent with the professional qualifications established by all recognized engineering societies, the initial difficulty of amateurs posing as professionals would be practically eliminated. A concerted effort in this direction should be undertaken without delay."

R. W. Macintyre.

Building Activity in Montreal and District

Several large buildings will be erected in Montreal and district this season, but indications point to chief activity in the construction of residences. The demand for office buildings has been fairly met, and the permits taken out show that there will be very little work of this character, except for special purposes. Thus the London, Liverpool & Globe Insurance Company will erect a large office on Dorchester Street, from designs by Nobbs & Hyde and J. Rawson Gardiner. The Bank of Toronto intend to demolish their present building at the corner of St. James and McGill Streets, and construct a ten-storey building on the same site, the plans having been drawn by Hogle & Davis. The ground floor is to be used for a banking room, which is to be sixty feet square, and the upper floors for commercial and financial offices. The frontage on St. James Street will be 90 feet and on McGill Street 60 feet, the main entrance being on the former thoroughfare. A new building for the National Trust will go up on St. James Street.

Probably the greatest amount of money will be spent on churches and schools. Messrs. Viau & Venne are drawing plans for a very fine church to replace the St. Joseph Oratory, on Mount Royal, which will have a seating capacity of 2,500, and will be the largest church in the city. One of the most important Anglican churches, St. George's, is to be built from designs by Barott, Blackader and Webster. The interior length is 185 feet; the breadth, including the side aisles, 50 feet; the chancel 52 feet in length, and the height of the nave 65 feet, while the main tower will rise 120 feet above the ground. The main and solo organs will be placed in the chancel. The church will be connected by cloisters to the school house and rectory. It will be constructed of Indiana limestone. The church will be on Dorchester Street West, and the nave and tower are to be on the axis on Bishop Street. A fine college is to be built by the Loyola College at Notre Dame de Grace, the architects being Messrs. Peden & McLaren. The cost is estimated at $400,000. Another college is to be constructed in St. Lambert, from plans by Viau & Venne, at a cost of $175,000. Messrs. Beauregard, Champagne & Chenevert have designed two churches, one to cost $250,000, on St. Urbain and St. Viateur Streets, and the other to cost $150,000, on Fullum Street.

There are reports of two or three schemes for new theatres, but the only one which is certain is for a Jewish theatre on St. Lawrence and Duluth, planned by Mr. C. Dufort. A large hippodrome, however, is to be constructed in Maisonneuve. Several substantial factories will be erected, including buildings for the Simonds Canada Saw Company and for the United Shoe Machinery Company of Canada, the latter in Maisonneuve, both contracts being let to C. E. Deakin, Limited. The Tuckett Tobacco Company are also erecting a factory.

Some important buildings will be completed this season. One is the new office for the Sun Life Insurance Company, and another the immense factory of the Imperial Wire and Cable Company, now incorporated with the Northern Electric Company. Great progress has also been made with the new customs warehouse on McGill Street, the foundations for which were put in by the Foundation Company. The general contractors are the Peter Lyall & Sons Construction Company.

From returns received by the Quebec Mines Branch from the producers it is learned that the value of the products of the mineral industry of the Province of Quebec in 1913 total $12,918,109. The mineral production of the Province for 1904 was $3,023,568.

On the recommendation of the Faculty of Applied Science, McGill University, it has been decided to take steps to lengthen the course of architecture from four to five years, commencing with the session 1914-15.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

The Skootamatta Power & Development Company, Limited, has been incorporated at Hamilton with a capital of $300,000.

The Chatham town council has postponed the appointment of a building inspector pending the preparation of a building bylaw.

One of the large fires of the past week was the new summer hotel of the C. P. R. at St. Andrews, N.B. The damage is placed at $500,000.

Mr. W. Grayson Brown, of Hamilton, is the architect for a three-storey brick apartment house to be erected in that city at a cost of $125,000.

At Charlottetown, P.E.I., work is proceeding on a $200,000 church for St. Dunstan's R. C. cathedral. The contractors are Messrs. John S. Metcalfe Company, of Montreal.

The foundations are in for a new school building which the R. C. School Commissioners are erecting at Quebec at a cost of $200,000. The architect is Mr. R. Lemay, of Quebec.

The roof of the mixer of the new blast furnace at the plant of the Dominion Iron & Steel Company, Sydney, N.S., fell on April 13, crushing four men who were working in the mines at the time.

A committee representing the contractors of Fort William and Port Arthur have arranged to meet a deputation of the bricklayers of the twin cities for the purpose of arranging a wage schedule for the coming building season.

A call for tenders is about to be issued in connection with the office building which the Liverpool, London & Globe Assurance Company are erecting at Montreal and for which Messrs. Nobbs & Hyde, of Montreal, are the architects.

Excavation is proceeding on the addition to the buildings of the University of Ottawa, which is being made at a cost of $150,000. The architect is Mr. C. P. Meredith, of Ottawa, and the general contractor Mr. C. E. Deakin, of Montreal.

Plans have been prepared and accepted for a hydro-electric plant at Lake Megantic, Que., estimated to cost $150,000. The engineer-in-charge is Mr. E. A. Evans, of Quebec City.

Frasers, Limited, who operate a large lumber mill at Fredericton, contemplate erecting a large number of model working men's houses during the coming summer for their employees.

Messrs. Horwood, Taylor & Horwood are the architects for a store and apartment building on Rideau Street, Ottawa, upon which excavation work is now proceeding. The estimated cost is $180,000.

The Kennedy Construction Company, Montreal, have been awarded by the C. P. R. the contract for extending the present masonry abutments and piers in concrete on the Humber River, Ontario.

Mr. J. R. W. Ambrose, chief engineer of grade separation of the G. T. R., has been appointed chief engineer of the Toronto Terminals Railway Company, which will build the joint C. P. R. and G. T. R. station in Toronto.

An echo of the Woodbine Hotel fire tragedy at Toronto is heard in the announcement that Mr. F. H. Herbert, of that city, is preparing plans for a new 10-storey hotel building, of fireproof construction, estimated to cost $250,000.

Tenders are being called for the construction of a new lower grade school building at Fredericton, N.B. The estimated cost of the new building is about $30,000 and it is expected to have it ready for occupancy this year.

Work has been resumed on Fredericton's new Post Office. This building will call for the expenditure of over $300,000 before completion. It is steel frame with free stone body. The old post office will be transformed into a Customs House.

A street and domestic lighting system is to be installed at Beloeil, P.Q., at a cost of $20,000. The scheme includes the construction of a transmission line five miles long, the lamps being placed on cedar poles at distances giving 42 lamps per mile.

Building activity in St. Catharines so far this year promises to exceed all previous records. The returns for March show that permits to the value of $110,975 were issued by the city clerk as against $41,730 in the corresponding month last year.

Messrs. Brunet & Leclerc, of Lachine, have the contract for a college at St. Lambert, Que., estimated to cost $150,000. Messrs. Viau & Venne are the architects. The new building will be three storeys high, of fireproof construction, and will cost $150,000.

The building outlook for Toronto this year is summed up by contractors generally as being much more promising than last year. Industrial activity is everywhere apparent and the brick yards in and around the city are producing in the neighborhood of a million bricks a day.

Upon the completion of the new annex to the Provincial Normal School, Fredericton will be credited with having the largest educational building in New Brunswick, if not in the Maritime Provinces. The recent addition to the Normal School cost in the vicinity of $50,000.

At Maisonneuve, Que., the United Shoe Machinery Company are to erect a new factory at a cost of $300,000. The building will be two storeys high, 164 ft. by 140 ft. in dimensions, of brick construction. The general contractors are Messrs. C. E. Deakin, Limited, Montreal.

A 50,000 volt transmission line from [illegible] to St. Hyacinthe, P.Q., is being constructed by the Southern Canada Power Company, which recently acquired power plants at St. Hyacinthe and St. Johns, and water powers near Drummondville. It is intended later to extend the line to Sherbrooke and link up the various plants into a complete power system.

The city of London, Ont., is advertising for tenders to carry out a large scheme of storm sewer construction. The work will comprise 9.14 miles of city mains and 2.66 miles of connections to catch basins. Messrs. Chipman & Power, Toronto, are the consulting engineers and Mr. Wm. N. Ashplant, City Engineer, is in charge of the work.

In the architectural competition conducted by the government with regard to plans for the new supreme court building at Ottawa, six preliminary designs have been selected out of a large number submitted. The choice was made by a board drawn from among the officials of the department of public works. The final decision will not be announced until early in September.

The main building, ten storeys high, of the new sugar refinery at St. John has been erected, and rapid progress is being made on the other buildings making up the complete plant. The new refinery on one side and the new C. P. R. grain elevator on the other stand as sentinels at the mouth of the harbour, indicating the industrial and commercial importance of St. John.

It is expected that new tenders will be called for the heating of Howick Hall, the building within the Central Canada Exhibition grounds, Ottawa, which was partially wrecked by explosion some time ago. The objection to Mr. H. A. Knox's tender, which was the lowest, was that it was not opened until the figure of the other persons tendering had apparently been made known.

The Government has not yet decided as to whether there will be any legislation passed this session on the report of the Highway Commission on good roads. For the coming season at least the department of public works will adopt the suggestion of the Commission in encouraging, as far as possible, the continuation of the work by the counties under the Highways Improvement Act.

A carload of ore from what is called the Cobbler-Sexton mine near Woodstock was sent to New York a few months ago to be assayed. It is said that the ore is sufficiently rich in gold and copper to warrant the development of the mine, and word comes from New York that a smelter and concentrator will be installed, and in the neighbourhood of half a million dollars spent by a new company which will take over the property.

After several months of preparation, work was commenced on April 16 on the reconstruction of Toronto harbor. Operations were begun on what is known as the northern slip at the foot of Cherry street, the object of this work being the reclaiming of a large area of land for industrial purposes. It is proposed to enlarge Keating's channel from its present width of 80 ft. to 120 ft. The Canadian Stewart Company are the contractors.

Building statistics showing records of houses erected since 1862 and the values from 1884 have been compiled in the building inspector's department at Montreal. In 1884 a total of 317 houses built represented a value of $1,014,015. With valuations varying slightly the period from 1897 to 1909 was marked by a steady increase, values in the latter year being [illegible] and for the year 1912 [illegible] an increase of nearly $8,000,000 was shown. The year 1911 showed [illegible] houses representing a value of [illegible].

The concrete work at Cote St. Paul locks of the Lachine Canal has been completed by the Government engineers and the sluice gates placed in position prior to the opening of navigation. The work being carried out by the Government is not merely the construction of a new power house but the excavation and opening of a new inlet to the Canal for the purpose of supplying more water. The entire work will cost upwards of $[illegible]00,000. About 100,000 cu. yds. of earth will be excavated in removing the curve in the vicinity of the locks.

A company known as Concrete Builders', Limited, has secured a building at Gibson, opposite Fredericton, and is installing machinery for the manufacture of marble-faced pressed brick, ornamental cornices, pressed brick, water pipes, tile pipes and concrete blocks. The gravel for use in the factory will be dredged from the bed of the Nashwaak River. The directors of the company include Hon. H. R. Emmerson of Moncton; Hon. J. P. Burchill of Nelson; T. C. Burpee; J. J. McCaffory and other well known citizens of Fredericton.

Representatives of the contracting firm of Messrs. Jos. McVey & Son, Mr. A. R. Wetmore, chief engineer of the public works department, Mr. Springer, resident engineer, and representatives of the city and county of St. John, N.B., interviewed the government a few days ago in connection with the construction and substructure of the new bridge across the reversing falls at St. John. It was stated that owing to difference of opinion between the contractors and engineer Springer work had been delayed, the contractors refusing to carry out the engineer's orders. The department of public works will deal with the matter and see that the work is expedited.

The Montreal Board of Control in their report on the recent investigation into the break in the civic water supply conduit last December, place responsibility on the Cook Construction Company, the contractors, but recommend further examination of plans to decide this point with greater certainty. They believe that contributing causes of the break were, "too close proximity of excavation, method of excavation employed, and weakness of the conduit itself." Suspension of work until plans for widening the aqueduct can be thoroughly examined is recommended. The investigation, which lasted about three weeks, was mainly devoted to taking expert testimony.

In addition to a large amount of government work, particularly on the harbour, at Quebec, a fair amount of building is either being carried out or is contemplated. The Bank of Montreal have purchased a site for a new branch at the corner of St. John Street and Palace Hill; C. W. Lindsay, Limited, will put up a five-storey building on St. John and Eustache streets; and the Good Shepherd Nuns will construct a school costing $250,000. The Post Office is also to be extended. The Canadian Stewart Company, Limited, have just completed for the Harbour Commissioners a million bushel elevator. This is situated on the Louise Docks and is constructed of concrete.

The "model city" at Montreal, which has been planned for the Canadian Northern Montreal Land Company, to be located on the further side of Mount Royal, received its charter in January, 1912. All the streets radiate from a central spot which is designated Connaught Square, around which will be situated the public buildings for the government of the town as well as the station of the Canadian Northern Railway, whose great tunnel scheme has rendered possible the realization of the project for utilizing the land on the further side of the mountain. It is said that the business streets will be at least 80 ft. wide and the residential streets 66 ft. wide with strips of grass on each side between roads and sidewalks. Fifteen miles of road have already been constructed and the work is progressing speedily. The requirements in regard to building are that all houses must be built of solid brick, concrete or stone, or be encased in brick.

Mr. J. Norton Griffiths, M.P., cables from England that two more dredges are on the way to St. John, N.B., and that another will be sent forward immediately to join the fleet now engaged in dredging Courtenay Bay, the new eastern harbour of St. John. The channel must be dredged into Courtenay Bay, and the basin dredged out inside the great new breakwater which is being constructed. The Norton Griffiths Company have given assurance that the work of dredging, building the breakwater, constructing the dry dock and the first of a series of wharves will be completed within the contract time, and this means great activity at the site of these immense harbor works. At west St. John three new steamship berths are to be completed before next winter, and the two contracting companies having the work in hand will have crews of men working day and night throughout the spring and summer on the timber substructure and the concrete face and surface. These wharves are to be equipped with steel warehouses, travelling cranes and all modern devices for handling traffic.

WESTERN CANADA

Tenders are about to be called for a post office building at Prince Rupert, B.C., estimated to cost $100,000.

At Winnipeg plans are in progress for a subway under the tracks on Portage Avenue. The estimated cost is $250,000.

The Mainer Electric Company, Limited, Winnipeg, have been granted permission to increase their capital from $100,000 to $500,000.

The date of submitting the bylaw to raise $250,000 for the extension of the Calgary waterworks has been postponed until April 30.

Tenders are to be called next month for a two-storey court-house, of stone and brick construction, at Swift Current, Sask. The estimated cost is $125,000.

Eight of the various building trade associations of Edmonton are now affiliated with the local Builders' Exchange, the last to come in being the sheet metal contractors.

Operations on the Saskatchewan Iron & Bridge Company's new factory at Medicine Hat are to be started again about May 1. The firm's headquarters are at Moose Jaw and the expenditure of $100,000.

At Calgary, Alta., on May 7 the ratepayers will be asked to vote on a bylaw to raise $300,000 for an electric light system. The superintendent of the city light and power department is Mr. R. A. Brown.

At Winnipeg, a syndicate has been formed to erect a new athletic club building at a cost of $750,000. A site has been selected and Messrs. Pratt & Ross, Electric Railway Chambers, Winnipeg, have been appointed architects.

Medicine Hat, Alta., is to have a flour mill estimated to cost $750,000. The prospective owners are the Maple Leaf Milling Company, Board of Trade Building, Toronto. It is expected that operations will be commenced about May 1.

Work is in progress in the new Arts building at Edmonton for the University of Alberta. The architect is Professor Burgess of the University and the general contractors are Messrs. Geo. A. Fuller & Company, Limited. The estimated cost is $500,000.

The new plant erected for the Mainland Ice & Cold Storage Company at Vancouver has been placed in operation. The building is five storeys high, 88 ft. by 100 ft., and of fireproof construction, the block being lined with two layers of cork and the coils of refrigerator pipe and cold air ducts.

The public works department of the Provincial Government is co-operating with the various municipalities in Alberta for the purpose of constructing main trunk roads between the principal market centres. Half a million dollars, which has been set aside out of the current revenue for road construction this year by the public works department, will be expended largely in improving the most used traffic roads, and with a view to completing in the next few years a system of main trunk highways.

It is stated that there is a likelihood of operations being renewed on the Empire Theatre at Edmonton, the excavation for which was taken out two years ago. The estimated cost of the building is $200,000 and the prospective owners are the Empire Theatre Company, of Edmonton.

In a lecture before the Royal Colonial Institute, London, Eng., upon the effect of the Panama Canal on Western Canada, Dr. F. B. Brooman, of Vancouver, said that the canal was already throwing a new economical and continental divide across Canada, two-thirds of whose future products were destined to be shipped by the Pacific.

Work is expected to be completed on the two remaining piers of the new 25th Street bridge at Saskatoon by June 1. The piers will be put in from scows, after which the construction of the reinforced concrete arches upon the piers already put in will be undertaken. The contract is being carried out by Messrs. R. J. Leckey & Company.

The Government of Saskatchewan has approved of plans for the building of a retaining wall on the north side of the Saskatchewan River. The Commissioners have apopinted a committee to take up the matter with the city engineer and report to the city council. The cost has been estimated roughly at $125,000, of which the Government would probably vote $100,000.

Six bids were received by Victoria city council for the fabrication and laying of the steel rivetted pressure pipe line for the Sooke Lake waterworks system. The specifications call for 10½ miles of 35-in. steel pipe, half of the plates to be 5-16-in. in thickness and half ⅜-in. The city has decided to do the trenching and back-filling by day labor. The tenders will be finally dealt with and the contract awarded at an early date.

Tenders will be called shortly for the erection of an office building for the Saskatchewan Co-operative Elevator Company, Limited, at Regina. Messrs. Store & Van Egmond are preparing detailed plans, and construction will be commenced during the summer. The type of construction will be reinforced concrete, sufficiently strong to carry two additional storeys if necessary at a later date. The exterior of the building will be a combination of pressed brick and terra cotta.

Building in Calgary shows satisfactory evidence of activity, judging by the returns for the first three months of the present year, which total about $600,000. According to the building department the outlook for the year is exceptionally hopeful, especially as the Dominion Government is preparing to expend large sums this year and next in the construction of a new post office building, terminal storage elevator and an armoury. It is also expected that permits for the new Canadian Northern and Grand Trunk Pacific depots at Calgary will be taken out this year.

The prediction that 1914 will be a year of much building construction in Winnipeg appears to be borne out by the permits issued so far this year. The record for the three months ending March 31 is $714,650 greater than the total value of the permits issued for the same period last year, and is only $175,760 lower than the record set in 1912. The total for the three months of this year shows 493 permits issued for 570 buildings, aggregating in value $2,839,550. In the permits issued to date there are practically no large office structures, of which quite a number of any size are for apartment blocks, and the heavy work has not yet been commenced. A five-storey addition is to be made to the Manitoba Cold Storage Plant at a cost of $60,000.

The Directors of the Burrard Inlet Tunnel & Bridge Company have received bids for the construction of the proposed bridge across the Second Narrows, B.C. The bridge, including the approaches, will be nearly one-half mile in length. It will consist of one wide swing span, 581 ft. 6 in. long, two fixed spans, 232 ft. long and two viaduct approaches. The structure will be entirely of steel and the roadway will be paved with wood blocks and will rest upon six piers. The draw will revolve on a platform supported by four wrought steel cylinders braced together and filled with concrete. The bridge itself will be of the Warren Brothers type. Separate accommodation will be provided for steam, street car, vehicular and pedestrian traffic. A clear headway of 45 ft. above high-water level will be provided and a clear waterway of 225 ft. will be available when the draw span is opened. A swing span will be operated by electric motors. Electrically-operated gates will safeguard the draws on either side and an elaborate system of signals and telephone connections will be used to direct traffic, both on the bridge and in the channel. The bridge was designed by the British firm of Sir John Wolf Barry, Lyster & Partners, Messrs. Cleveland & Cameron, of Vancouver, being the local associates, who carried out the preliminary work including test borings. Fifty large scale drawings were used to describe the specifications.

Interesting Addresses by Canadian Engineers

"Civic Road Building on an Economic Basis" was the subject of a report made to the town council of Amherst, N.S., by Mr. J. E. Lusby, who attended the recent Good Roads congress at Chicago. He stated that extensive experiments had been made by experts who had studied each phase of road construction, endorsing concrete as the coming pavement. The new design was a width of 16 ft. to 18 ft. such as would permit two motor busses to pass at a speed of twenty to twenty-five miles an hour. Instead of the high crowned centre which prevented cracking and tended to drain off water in bitulithic, an almost flat surface was agreed upon, but the centre had an exact thickness and was two inches higher than the sides.

Addressing the Institute of Civil Engineers at London, Eng., on April 8, on "The Transportation Problem in Canada and Montreal Harbor," Mr. F. W. Cowie, who is one of the Commission at present making tour of inspection of European and British ports, referred to the fact that with the possible exception of the development of Glasgow Harbor there was no more romantic episode in the annals of harbor engineering than the making of Montreal an ocean port. Mr. Cowie described at length the design, capacity and cost of Canadian grain elevators, making interesting comparisons with the methods of handling grain in other countries.

In a lecture on "The Engineer and the Public" delivered before the Ottawa Branch of the Canadian Society of Civil Engineers, recently, Mr. W. J. Francis, consulting engineer of Montreal, commenting on the different definitions of an engineer stated it had been estimated there were 110 varieties. The action of corporations and individuals in frequently inviting competition between engineers and which occasionally resulted in other than Canadian engineers being given important work, was condemned by Mr. Francis who asserted that engineers had a right to expect that they would be given the preference in their own country. Advice from engineers of other countries might be obtained if necessary, but the native engineer should be allowed to carry out the work.

Personal Mention

Mr. [illegible] Carter has resigned his position as Municipal Engineer of West Vancouver, after a service of two years.

Mr. A. J. Donegan has received an appointment as superintendent of the Algoma Eastern Railway, with headquarters at Sudbury, Ont.

Mr. John C. McGregor, a well-known Toronto builder and contractor, died on April 12 in his 81st year. Mr. McGregor was a native of Moffat, Scotland.

Mr. L. C. Fritch, chief engineer of the Chicago Great Western Railroad, has been appointed assistant to the president of the Canadian Northern Railway, with headquarters in Toronto.

Mr. Henry Sheard, a Toronto architect who retired from business about twenty-five years ago, died on April 8 after a short illness. He was born in Toronto in 1853 and lived practically all his life in the city.

Mr. Wm. Pearse, who is an applicant for the vacant office of City Architect of Toronto, is a native of the Queen city. After passing the final examination of the Ontario Association of Architects, he went to New York, took a five-year course in civil engineering at Cooper Union where he graduated in science, and later in civil engineering. Subsequently in Germany he took a three-year course in engineering and twelve years ago passed the three-day naval examination as a first-class structural draughtsman. Mr. Pearse is first vice-president of the Ridley Steel Construction Company, Long Island City, New York, and is an expert specialist and consulting engineer.

Canadian Railroad Development

According to a statement made recently by Mr. McNicholl, first vice-president of the Canadian Pacific Railway, the Lake Shore line near Toronto will be complete and ready for passenger traffic about July 1. Work on the construction of the new Union Station will probably be commenced in May.

The last rivet was welded a few days ago in the new C. P. R. bridge at Donlands on the line of Woodbine Avenue, nine miles from Toronto Union Station. The new bridge, which is of steel construction, is nearly 1,000 ft. long and weighs over 1,200 tons. It is supported on nine steel towers and two concrete abutments. It gives the C. P. R. a double track from Streetsville to Agincourt. The Walkerville Bridge Company are the builders, the contractors for the cement work being Messrs. Dickinson & Burns. The double tracking of the line from Agincourt to Leaside will be done by Messrs. Stein & Read.

In an address on "City Planning" at the City Development Exhibition in Toronto a few days ago, Mr. J. P. Hynes suggested the construction of a steam railway service for suburban Toronto, running east and west from the Yonge street crossing to a point twenty-five miles distant on each side from the heart of the city. For this purpose a Grand Central station would be built at Yonge street and a number of stations at various distances along the line. Eventually the road could be linked up with the proposed railway to be operated by the Harbor Commission, and in this way would belt the city.

Mr. Morley Donaldson, vice-president and general manager of the Grand Trunk Pacific witnessed the linking up of steel east and west on April 8 by the laying of the last mile of track. There was no elaborate ceremony, only officers of the railway being present. The formal ceremony, to include the driving of the golden spike, will take place later. The point where the steel joins is Nechako River, B.C., 371 miles east of Prince Rupert and 1,375 miles from Winnipeg. Since the beginning of the year steel has been laid on 143 miles of line. The construction of the line was commenced at Manitoba Sand Hill in October, 1905, while work from the Pacific was commenced in May, 1908. The laying of steel was started in September, 1906, at Portage La Prairie.

Publications Received

The Asbestos Manufacturing Company, Limited, 263 St. James Street, Montreal, have issued an attractive booklet, entitled, "The Town of Asbestoslate." This booklet illustrates some charming homes and attractive buildings roofed with Asbestoslate. It contains many valuable pointers for prospective builders.

"Waterproofing for Cement Houses," is a booklet in which the problem of waterproofing cement stucco houses is discussed logically and interestingly. Such a careful treatment of this subject is bound to increase interest in the use of cement stucco and in the necessity of safeguarding against dampness. The booklet is issued by the Ceresit Waterproofing Company, Chicago.

"Flat Slate Roofing" is the title of a book received from the North Bangor Slate Company, the purpose of which is to show that flat slate roofs have stood the test of time and earned a record for durability, economy and general satisfaction. The book contains the published testimony of architects and others as well as illustrations of various types of flat-slate-roofed buildings. The Bangor Slate Association, Bangor, Pa., offer to deal with all enquiries, sending full information and suggestions for specifications.

Trade Notes

The Industrial Engineering & Machinery Company, Limited, Montreal, Sales Agents for the Traylor Engineering & Manufacturing Company of Allentown, Pa., have just secured from the Asbestos Corporation of Canada, for their Thetford Mines Mills, an order for a 60-in. "Blake" type Jaw Crusher. This will be the largest crusher in the Thetford district.

We are informed that excellent results have been obtained in Keystone copper bearing steel sheets since they were placed on the market last year by Messrs. B. & S. H. Thompson & Company, Limited, Montreal. These sheets have demonstrated much greater durability than ordinary steel sheets and are, therefore, particularly adaptable for use in the manufacture of all exposed sheet metal work. Messrs. Thompson are prepared to supply a descriptive booklet and samples to all interested.

Messrs. M. Beatty & Sons, Limited, recently launched the dipper dredge which they are building for the C. S. Boone Dredging & Construction Company, of Toronto. This dredge is of steel and is 100 ft. long, 40 ft. wide, 10 ft. deep at bow and 8 ft. at stern. It is of the Crane type, the crane being 40 ft. long. The dipper is of 5 cubic yards capacity. The dipper handle is 61 ft. long, which will allow it to make 40 ft. of water. The main engine is double cylinder, 15 in. bore by 15 in. stroke, the boiler being 10 ft. diameter by 12 ft. long, of the Scotch Marine Type. Each bow anchor or spud is operated by an Independent Reversible Engine 10 in. bore by 10 in. stroke, compound geared, the anchors being raised and pinned up by steel cable. The engine for handling the stern anchor is 9 x 9 compound geared. Located on each side of the deck forward, is a 7 x 7 double cylinder triple friction drum engine, which is used for warping the dump scows into position. Messrs. Beatty expect to have the dredge completed and ready for towing by the first of May.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Berlin, Ont.

Tenders will be received by the City Clerk, A. H. Miller, until 5 p.m. April 30th, for the laying of creosoted wood block pavements on Water and Weber Sts. Plans are at the offices of the Canadian Engineer, 62 Church St., Toronto, the City Engineer, Berlin, and Hugh C. MacLean, Ltd., 220 King St. W., Toronto.

Burnaby, B.C.

With reference to the proposed paving of Barnet Rd., the city engineer reports the cost of paving 6.4 miles, first 2 miles at $30,000 per mile and balance at $40,000 per mile.

Calgary, Alta.

The city has been authorized to expend the sum of $1,003,600 for grading and filling. These improvements will cover a period of about three years.

A by-law is to be submitted to the ratepayers on April 30th, for authority to raise the sum of $50,000 for extensions and improvements to the parks, including erecting and improving park buildings, and at the same time the ratepayers will be asked to sanction the expenditure of $250,000 on extensions to the waterworks system.

Camrose, Alta.

A by-law authorizing certain extensions to the sewer and waterworks systems has been passed by the municipal council.

Eastview, Ont.

The town council is considering the laying of concrete sidewalks on 4 streets.

Hamilton, Ont.

The Board of Control has decided to abandon the question of the construction of a reservoir for this year.

Hamilton, Ont., Dundas

Plans for the construction of sewers and a sewerage disposal plant are being proposed by the engineers, T. Aird Murray & Lowe, 186 King St. W., Toronto.

Jarvis, Ont.

Tenders will be received by the Reeve until April 28th, for the construction of 10,624 sq. yds. of "Tarvia filled" or "Rocmac" macadam roads. Specifications are at the offices of the Canadian Engineer, 62 Church St., Toronto; The Engineer, Brantford, and Hugh C. MacLean, Ltd., 220 King St. W., Toronto.

Kingston, Ont.

The purchase of a street sweeper is being considered by the city council.

Lake Megantic, Que.

The municipal council proposes to expend the sum of [illegible] on pavements and sidewalks. Engineer-in-charge, E. A. Evans, 92 St. Peter St., Que.

London, Ont.

The paving of the Talbot St. school yard is proposed by the Board of Education.

Montreal, Que., Pointe Claire

Tenders for the construction of roads will be received by the Sec.-Treas., until noon May 6th. Plans are at the office of the engineer, G. C. Anderson.

Montreal, Que.

F. J. Jago & Co., 10 Victoria street, who have the general contract for the filtration plant, are still taking tenders on roofing, ornamental iron, plumbing, structural steel and electrical work.

Moose Jaw, Sask.

Tenders will be received by the Commissioners until 10 a.m. May 6th, for the supply and delivery of Contract No. 82, 115,000 ft. sewer tile pipe, 4 in.-36 in. diameter. Contract No. 83, 1,120 tons cast iron pipe, 55 tons special castings. Contract No. 84, 177-6 in., 8 in., 10 in. and 12 in. gate valves, 83 fire hydrants. Specifications are at the office of the engineer, Geo. D. Mackie.

Orford Twp., Ont.

Tenders will be received by the Clerk, F. Littlejohns, Highgate, Ont., until April 25th, for 2,100 yds. open drains 4 ft. wide, with culverts.

Ottawa, Ont.

Plans are to be drawn for the laying of pavement on Nicholas and Hurdmans Rd., from Laurier E. to Hurdmans Bridge, a distance of 1½ miles. The material will be either concrete or asphalt macadam. City Engineer, Arch. Currie, City Hall.

Prince Albert, Sask.

Surveys have been made for concrete walks, curbs and gutters on various streets, at an estimated cost of $11,000. Specifications, etc., are at the office of the engineer, Angus Smith, City Hall.

Tenders will be received by the Clerk, C. O. Davidson, for 4 in., 6 in., and 8 in. storm sewer, outfalls and hydrants, valves, meters, etc. Tenders for the construction of boulevards are also invited. Specifications, etc., are at office of the engineer.

Plans for alterations to the sewage pumping station, at a cost of $4,500, have been drawn.

Plans have been drawn for water main extensions, at a cost of $75,600, ⅝ in., ¾ in., 1 in. and 2 in. water pipe, pumps, valves, hydrants, meters, etc., will be required.

Regina, Sask.

Tenders will be received by the City Commrs. until May 12th, for the supply of 153,275 lin. ft. 6 in.-60 in. sewer pipe; 1,500 No. 6 off 8 in. x 2 ft. tees; 200 No. 6 off 9 in. x 2 ft. tees. Specifications are at the office of the engineer, F. McArthur.

Tenders will be received by the City Commrs. until May 12th, for the supply of 400,000 sewer brick, 346 manhole covers and frames, 3,325 manhole steps, 6,000 lbs. oakum. Specifications are at the office of the engineer.

Riviere du Moulin, Que.

Tenders will be called in May for the construction of 6,000 ft. 4 in. concrete sidewalks. Engineer-in-charge, Grenon & Lavoie.

Simcoe, Ont.

Tenders will be received by the Clerk, W. C. McCall, until April 30th, for the laying of branch sewers and the constructing of manholes, together with the laying of house connection to the street line, a distance of four miles.

Sudbury, Ont.

Wm. H. Owens, architect, 18 Baikie-Gill Block, wishes to receive information on paving material.

St. Catharines, Ont.

The Board of Works recommends 4-ft. concrete walks and gutters on Yale Cres., Seneca, Wiley, Marren, Riordon and Vine streets, also pavements on Vine and Yate streets; the construction of sewers on Chapline ave., Seneca, Riordon, North and Albert streets is also recommended. J. K. Petrie, Mayor.

St. Paul, Man.

A by-law providing for improvements to the roads at a cost of $27,000, has been passed by the municipality of St. Paul.

Toronto, Ont.

The Commissioner of Works recommends that the contract for engineering connected with Island filtration plant be awarded to the John Ver Mehr Engineering Co., London, Eng., and Confederation Life Bldg., Toronto, who submitted the design and contract for work to Wm. Cowlin & Sons (Canada) Ltd., Bristol, Eng., and Mail Bldg., Toronto. The recommendation is being considered by the Council. The system adopted is the Ransome sand filter, combining both the sand and mechanical system. Capacity 60,000,000 gals. Buildings: Filter house, 230 x 123, pumping station, 140 x 75, suction well building, chemical and cold storage building, steel wash water tank, capacity 200,000 imp. gals., chimney 120 ft. high by 7 ft. diam., wharf, etc. Hydro and steam power will be used; a 1,200 kilowatt steam turbine is to be operated by 4,300 h.p. boilers.

Tenders will be received by the Board of Control until April 28th, for the construction of sewers on 11 streets, 5 lanes and midway dist. drainage system.

Winnipeg, Man., St. James

Plans for a subway under the tracks on Portage Ave. are being drawn. The estimated cost is $250,000.

Winnipeg, Man., St. Vital

Tenders will be received by the Sec.

[illegible] St. Vital Municipal [illegible] 8 p.m. May 6th, for 2,840 [illegible] 8 in., and 15,650 ft., 6 in. water pipes; 14-12 in., 16-8 in. and [illegible] and 81 hydrants. Specifications are at the office of the Engineer, Municipal Hall, St. Mary's Road, [illegible]

CONTRACTS AWARDED

Berlin, Ont.

[illegible] contracts have been awarded by the city council. Cement and cement sewer pipe, R. Boehmer, 231 King St. W.; catch basions, Berlin Foundry; concrete tile, Scheifele & Fisher, Waterloo; curb irons, A. B. Miller; concrete curbs and gutters, David Christner, 93 David St.; cement sidewalks, C. Darnman; manhole castings, The Forwell Foundry Ltd., 225 Queen St. S.

Esquimalt, B.C.

The contract for Section "D" of the sewer system has been awarded by the Municipal Council to Hugh Macdonald, Victoria.

Ford City, Ont.

The contract for pavements construction has been transferred to Gouin & Desjardins, Tecumseh, Ont.

Halifax, N.S.

The contract for iron pipe has been awarded by the municipal council to Drummond, McCall & Co., 28 Victoria Sq., Montreal, Que., at $30.80 per ton.

Montreal, Que.

The following additional contracts for paving material have been awarded by the Board of Commrs. Stinson-Reeb Builders Supply Co., Ltd., E. T. Bank Bldg., inorganic dust at $5.75 per ton. Laurentian Granite Co., Ltd., 224 St. James St., paving blocks, granite blocks.

St. Catharines, Ont.

The contract for the laying of vitrified tile sewers on Western Hill has been awarded by the City Council to Thos. E. Riley, 72 James street.

Sarnia, Ont.

The contract for the construction of cement walks has been awarded by the town council to Gus. E. Pethke, 122 St. Vincent St.

St. Joseph d'Alma, Que.

The contract for the construction of macadam roads has been awarded by the Municipal Council to Mr. Gaudreault, St. Joseph d'Alma, at $320 per 180 ft.

Toronto, Ont.

The Board of Control has awarded to the Commr. of Works the contract for the laying of asphalt pavements on Armoury St. $3,271, Logan Ave. $6,013, Morse St. $11,531, Woodbine Ave. $12,-[illegible]

The Board of Control has awarded the following sewer contracts. Edgewood Ave., $13,997, Fussel-McReyolds Co., Dundas St.; Scarboro Rd., $6,288, National Contracting Co., 9 Garnock Ave.; Windeat St., $533, Asphaltic Concrete Co., 74 King E.; North Toronto grade separation and Paton Rd. to Commr. of Works, R. C. Harris.

Victoria, B.C.

The city has decided to let the contract for the construction of steel rivetted pressure pipe line for the Sooke Waterworks system to Burrard Engineering Co., Vancouver.

Winnipeg, Man.

The Board of Control has awarded to J. W. Astley, Engineer of Constr., City Yards, the contract for pump houses Nos. 20, 21 and 24.

The Board of Control has awarded to J. W. Astley, Engineer. of Constr., the contract for the construction of sewers in Wolfe St., Martin Ave. and Grey St.

Railroads, Bridges and Wharves

Goat Island, N.S.

Tenders for the construction of a solid stone wharf will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. May 11th. Plans and specifications are at the offices of the Dist. Engineers, Halifax, Antigonish, N.S., with the Postmasters at Carsdale and Granville Ferry, and also at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Goderich, Ont.

Tenders will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. April 28th, for dredging the outer entrance to Channel; sand, gravel, clay and silt, is estimated at 148,700 cu. yds. Specifications at Dept., Ottawa, and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Hamilton, Ont., Dundas

The construction of 2 bridges is being considered by the town council.

Port Hope, Ont.

Tenders will be received by R. C. Desrochers, Sec., Public Works Dept., Ottawa, until May 11th, for the necessary dredging and excavating, and the construction of a revetment wall 145 ft. x 16 ft. x 16 ft., stone filled cribs with superstructure of concrete. Plans are at the office of Dept., Postmaster, Port Hope, and J. G. Sing, Confed. Life Bldg., Toronto. Specifications also at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Red Deer, Alta.

The Dominion Government has appropriated $3,000 to assisting the C. P. R. in bridge construction.

Toronto, Ont.

The Property Committee has decided to rebuild Smith Bridge on Yonge St., near the York-Markham townline.

Trenton, N.S.

The erection of a station, freight shed, etc.; at a cost of $16,500, is being considered by the Intercolonial Rly.

CONTRACTS AWARDED

Fitzroy Twp., Ont.

The bridge contracts have been awarded by the Twp. Council to concrete work, L. P. Lambert, Box 251, Campbellford; steel, Dom. Bridge Co., Lachine, Que., for one bridge; steel, Dickson Bridge Co., Campbellford, for one bridge.

Norfolk County, Ont.

The bridge contract has been awarded by the County Council to V. L. Oatman, Tillsonburg, Ont.

Toronto, Ont.

The York County Council has awarded to McDougall & Toole, Midland, Ont., the contract for the construction of the Massey bridge on Dawes road.

Weymouth, N.S.

The bridge contract has been awarded by the C. P. R. Co., to Powes and Brewer, Prince Wm. St., St. John, N.B.

Public Buildings, Churches, Schools, etc.

Calgary, Alta.

A by-law will be submitted to the ratepayers April 30th, for authority to make extensions to the public market, at a cost of $20,000.

Compton, Que.

The town hall by-law has been passed and the Municipality of Compton will have plans prepared immediately.

Chatham, Ont.

Plans to be drawn at once for a 4-room addition to McKeough School.

Campton, Que.

Plans have been drawn for the erection of a school building for the Prot. School Commrs., by D. Saultry, architect.

Edmonton, Alta.

The erection of a theological college in the University Grounds is being considered by the Anglican Synod.

A by-law providing for the construction of public swimming baths, at a cost of $76,180, has been passed by the City Council and work thereon will be started shortly.

A bylaw providing for the completion of the stock pavilion at a cost of $79,840 was carried April 6th. The building is to be completed this summer.

By-laws were passed on the 6th inst. sanctioning the following expenditure, completion of the Isolation Hospital, $59,860; the erection and furnishing of a central police station, $252,580; the erection of a city storage and warehouse building, $29,200; park improvements, including the erection of fountains, band stand, etc., $45,000.

Ford City, Ont.

The ratepayers will vote on by-law next month for the erection of town hall, fire hall and jail, at a cost of $25,000.

Hamilton, Ont.

H. G. Christman & Co., 32 Main E., who have the contract for the erection of the Y. M. C. A. building, invite tenders this week on all trades except plumbing and heating, which will be received by architects, Mills & Hutton, 804 Bank of Hamilton Building.

Nothing will be done this year with regard to the proposed erection of a municipal ice plant.

The proposal to make alterations and additions to the James St., Y. M. C. A., has been abandoned, and it is understood that nothing will be done with regard to the suggested Huron St. branch until next year.

The proposed alterations and addition to Christchurch Cathedral, include the installation of a central heating plant. Plans are to be prepared and presented to the church authorities in September.

East Hamilton, Ont.

Plans for the erection of a post office

are being drawn by the Government architect.

Hanna, Alta.
Bulk and separate tenders for various trades in connection with the erection of a school building will be received by L. DeJarkowski, Sec. to the School Board, until May 6th. Plans, etc., are at the office of the Edmonton Builders' Exchange, Edmonton.

Ingersoll, Ont.
Tenders will be received by the Sec., Public Works Dept., Ottawa, until April 29th, for alterations and additions to the post office. Plans are on file at "F," Station, Toronto.

Kintore, Ont.
Tenders for the erection of a church for the Presbyterian Church Congregation will be received by Sec. Bldg. Com., Geo. B. Anderson, R. R. No. 1, Lakeside, Ont., until May 2nd, for whole or part contract. Specifications are at the Journal Office, St. Marys, Ont., Wm. Crellins Store, Kintore, and at the office of the architect, W. G. Murray, Dom. Savings Bldg., London.

Lindsay, Ont.
Tenders for the erection of a school, on Cambridge St., will be received by the Sec. of the Board of Education, J. M. Knowlson, until April 28th. Plans, etc., at office of Dr. J. A. White.

London, Ont.
The erection of a church for the congregation of the Church of The Redeemer is being considered.

Long Branch, Ont.
The Presbyterian Church Congregation propose to erect a new church, a site for which is to be selected.

Mille Roches, Ont.
Tenders for the erection of a school buildings for School Sec. No. 4, will be received by the Sec.-Treas., R. A. Murdock, until May 4th, estimated cost $10,000.

Montreal, Que., Cote de Neiges
Viau and Venne, architects, 76 St. Gabriel St., Montreal, are drawing plans for a church for L. Oratoiri St. Joseph du Cote de Neiges, to seat about 2,500 persons.

Montreal West, Que.
Tenders for addition to Kensington Ave. School are invited by the architects, Peden and McLaren, 20 St. Alexis St., Montreal.

Montreal, Que., Rockfield
Tenders for the erection of a school building for the School Commrs. of Coteau St. Pierre, Aberdeen School, Montreal W., are invited by the architects, Peden and McLaren, 20 St. Alexis St., Montreal.

Montreal, Que., Villeray
.Tenders for the erection of a church and presbytery for the Parish of du St. Rosaire, St. Hubert St., Montreal, are invited by the architects, Viau and Venne, 76 St. Gabriel St., Montreal.

Morrell, P.E.I.
Plans for a parish house are being prepared for the R. C. denomination by C. B. Chappell, Box 93, Charlottetown. Tenders are to be called shortly.

Mt. Laurier, Que.
Plans for bishops palace for the Congregation of Mt. Laurier, have been drawn by Viau and Venne, architects, 76 St. Gabriel St., Montreal, who invite tenders.

Ottawa, Ont.
The competition on the erection of the Government Buildings is now closed. The judges have selected 6 of the designs submitted and the result of the final decision will not be announced until after Sept. 1st.

Additions to Welling St. School, at a cost of $10,000, are proposed by the Public School Board. Architect, W. B. Garvock, Creighton St. School.

Paquetville, N.B.
Plans for the erection of a church, at a cost of $50,000, for the R. C. Denomination are being drawn by R. A. Frechet, 30 Bonnacord St., Moncton.

Prince Rupert, B.C.
Tenders for the erection of a post office, at a cost of $100,000, will be shortly called by the Public Works Dept.

Quebec, Que.
Plans for extension to the school of the Sisters of St. Joseph, Notre Dame du Chemin, are being drawn by Quellet & Levesque, 115 St. John St., Que., who invite tenders.

Sandy Lake Reserve, Sask.
Tenders for the erection of farm building will be received by Duncan C. Scott, Dept. of Indian Affairs, Ottawa, up to noon April 27th. Plans and specifications are at the Dominion Land Office, Prince Albert, Post Office, Duck Lake, Sask., Thomas Borthwick, Indian Agent, Mistawasis, Sask., and at the Dept., Ottawa.

Ste. Agathe, Que.
Tenders for the erection of a public building will be received by R. C. Desrochers, Secretary, Public Works Department, Ottawa, until May 11th. Plans are at the office of the Department, Post Office, St. Agathe, R. L. Deschamps, P. O., Montreal and the architects, Finlay & Gagnon, New Birks Bldg., Montreal. Specifications at office of MacLean Daily Reports, Limited, 220 King St. W., Toronto.

St. Catharines, Ont.
The erection of a Citadel is proposed by the Salvation army; a site has been purchased at the corner of Court and Centre streets, and a campaign has been started to raise the necessary funds.

Springhill, N.S.
Tenders will be received by the Director of Contracts, Ottawa, until noon range. Plans, etc., at offices of Officer Commanding 6th Division, Halifax, N.S., Town Clerk, Springhill, Director Gen. of Engineer Service, Headquarters, Ottawa.

St. Marys, Ont.
Tenders will be received until April 29, by Watt & Blackwell, London, Ont., for the erection of a school building for the Board of Education. Estimated cost [illegible]

Toronto, Ont., Swansea
The Public School Board has under consideration certain additions to Windermere Ave. School, including an assembly hall, etc. The sum of $35,800 has been voted by the board.

Toronto, Ont.
Funds are to be raised by the congregation of St. Barnabas English Church, for new Sunday School building.

The Property Com. have passed plans for the erection of a new school on Orde St. Tenders will be called shortly.

The congregation of St. Marks English Church, Cowan Ave., has decided to enlarge the school house this year.

The St. Michaels English Church Congregation has decided to erect a new building at a cost of $50,000.

The enlargement of St. Marks English Church, West Toronto, is being considered by the congregation.

Funds are being raised by the congregation of St. Nicholas Church for the erection of a new building.

Funds are to be raised by the congregation of St. Bartholomew English Church, for the erection of a new school house.

The laying of a new tile floor and the redecoration of the interior is being considered by the authorities of St. James' Cathedral King and Church St.

Vancouver, B.C.
A site has been purchased at the corner of Gore Ave. and Keefer St., for the erection of a new postal sub-station.

Wetaskiwin, Alta.
Tenders will be received by E. E. Chandler, Sec., Public School Board, until 5 p.m. April 30th, for the installation of heating and ventilation in Alexandra School.

Weyburn, Sask.
The erection of a city hall and fire hall, at a cost of $50,000, is being considered by the city council. Architect, B. U. Boyum, Minneapolis, Minn., U.S.A.

Windsor, Ont.
The erection of a pavilion on the River Front is proposed by the city council.

Winnipeg, Man.
Plans for the completion of the Christian Scientist Church, Fort Rouge, are being drawn by Jordon & Over, Canada Life Bldg. Estimated cost $40,000.

Plans are in progress for the erection of a temple on Young St., for the Royal Templars of Temperance. Architect, P. M. Clemens, 331 Garry St. Tenders will be called in about 6 weeks' time; estimated [illegible]

Woodstock, Ont.
The erection of a Hospital for Epileptics is under consideration; the Provincial estimates include $10,000 for building.

Plans are in progress for the erection of a city hall, at an estimated cost of [illegible] London.

Welland, Ont.
A site on Grove and Muir Sts., has been purchased [illegible] the erection of a public library; estimated cost $20,000

CONTRACTS AWARDED

Brampton, Ont.
The contract [illegible]

connection with the school additions. General contractor, Henry Hill, includes brick, carpentry, painting, slate and iron; heating and ventilating, The Brampton Hardware Co.

Edmonton, Alta.

A contract for the erection of 2 fire halls has been awarded by the city council to Johnson & Johnson, 1074 Fraser Ave. Fire hall No. 9, $10,930; No. 10, $11,000.

Montreal, Que.

The following sub-contract has been awarded in connection with the Esplanade Ave. School alterations. Roofing, Geo. W. Reed & Co., 37 St. Antoine St. The general contractors, Anglin, Ltd., 65 Victoria St., are still taking prices on mill work, tile and marble work.

Montreal, Que., St. Lambert

The contract for the erection of a college building for the R. C. Commrs., has been awarded to Brunet and Leclerc, Lachine.

Ottawa, Ont.

The contract for the steel work in connection with the rebuilding of Howick Hall in the Exhibition Grounds, has been secured by the Dom. Bridge Co., Sparks street.

The following contract for alterations to Cambridge St. School, has been awarded by the Public School Board to McKinley & Northwood, 56 Rideau St., heating and plumbing. The carpentry will be done by day labor.

The contract for repairs and alterations to Percy St. School has been secured by G. Holbrook & Son, 425 Somerset St.

Quebec, Que.

The contract for the erection of a school for the School Commrs. of Notre Dame du Chemin, has been let to Audina & Olin, Notre Dame du Chemin.

Toronto, Ont.

The contract for alterations to Beech Ave. Methodist Church has been let to W. J. Hewitt, 24 Cedar Ave.

The contract for the erection of a poultry building, at the Exhibition grounds, has been awarded by the Board of Control to Wickett Bros., Ltd., 35 Deer Park Crescent.

Walkerville, Ont.

The contract for the erection of the post office has been awarded by the Public Works Dept. to Pigott & Healy, James St. S., Hamilton.

Business Buildings and Industrial Plants

Berlin, Ont.

Negotiations are in progress for the establishment here of a Canadian branch factory of the Royal Automobile Company, Detroit, Mich.

Campbellton, N.B.

The erection of stores and offices on Water street is being considered by S. W. Dunock.

Cooksville, Ont.

H. K. Bowden, Dundas street, is considering the erection of two stores, the present drug store is to be removed.

Edmonton, Alta.

Plans for the erection of a paint factory are being drawn for the Lavalle Lumber Co. General contractor, A. H. Harrer, 50 Morris street.

Plans for the erection of a garage are being drawn for the City Council by A. Jeffers, architect, civic offices.

The erection of an aeroplane factory in Edmonton is contemplated by the Curtis Aeroplane Factory, San Diego, Cal.

Fort William, Ont.

Plans for a business block on Simpson street are being drawn by M. McCulloch, 326 Miles street.

Plans for theatres on Victoria and Simpson streets at a cost of $40,000 and $20,000, are being drawn for T. P. Kelly, Victoria ave., by H. M. Scott, architect, Murray Bldg.

Plans for undertaking parlors and an apartment block on N. Brodie have been drawn for I. H. Cameron, 711 Victoria Ave., by R. E. Mason, architect, Victoria Block. Estimated cost $50,000.

Granby, Que.

Plans for a 2-storey business block on Main street have been drawn for H. Pare.

Hagersville, Ont.

Plans for a branch of the Union Bank of Canada are being drawn by McBride, Gilbert & Farncomb, architects, Dundas and Richmond streets, London, who will call for tenders shortly.

London, Ont.

The Dominion Abattoir, Ltd., propose to erect cattle sheds at a cost of $15,000.

Plans are being drawn for addition to the National Pool Room, Dundas street, by Watt & Blackwell, architects, Bank of Toronto.

Plans are in progress for additions to the store and office building of W. G. Young, on Dundas street. Watt & Blackwell, Bank or Toronto, are the architects.

Plans for a garage on Queens Ave. for J. C. Beemer, Carling street, are being drawn by J. M. Moore, architect, 435½ Richmond street.

Medicine Hat, Alta.

The work on the factory of the Sask. Iron & Bridge Co. will be started again about May 1st.

The plans for stores, offices and apartments on Montreal street for the Misses M. J. & H. M. Kellet, 219 Toronto St., are about completed. H. K. Oakes, Main and S. Railway streets, is the architect.

Montreal, Que.

A permit for the erection of stores and flats, on Beaubien and Casgrain Sts., at a cost of $12,000, has been issued to J. E. & J. H. Lafond, 2480 St. Urbain.

Plans for the erection of a theatre on St. Catherine street, for F. W. Stair, Toronto, are being drawn by Thos. W. Lamb, New York City and Stair Bldg., Toronto, Ont.

Mr. L. Solman, King St. W., Toronto, has secured an option on a suitable site and proposes to erect a theatre.

A permit for the erection of a shelter on the race track has been issued to the Montreal Driving Club, Delorimier Race Track.

A permit for the erection of a stable at a cost of $13,000, has been issued to Michael Stafford, 409 Aqueduct. C. E. Deakin, 41 Mayor street, is the contractor.

Tenders for the erection of a boiler house for the Toilet Laundry Company, Limited, Richmond street, are invited by the Architects, Hutchison, Wood & Miller, Royal Insurance Bldg.

A permit for the erection of a warehouse has been issued to F. Sanche, 1309 Cadieux.

A. F. Byers, 340 University street, who has the contract for the Cotes des Neiges winter tennis court, is receiving tenders for roofing, plastering, electrical, skylights, plumbing and heating.

Montreal, Que. (St. Henry)

C. E. Deakin, Ltd., 41 Mayor, who have the contract for the Simonds Can. Saw Company's factory, is taking prices now for steel sash.

Montreal, Que., Lachine

Hudon & Orsali, 259 St. Paul St., Montreal, have decided not to proceed with the building of their proposed hotel this year.

Red Deer, Alta.

Plans for a business block have been drawn by G. W. Greene, 3rd St. N., who will call for tenders shortly.

Regina, Sask.

The Metal Shingle & Siding Company of Preston, Ont., contemplate building a western branch here.

The erection of a warehouse here is being considered by the Northern Electric Co. of Montreal.

Sudbury, Ont.

Sketches for the erection of stores, assembly and lodge rooms for the I. O. O. F. have been submitted by W. H. Owens, 18 Baikie-Gill Block.

Toronto, Ont.

The Canadian Aviation Co., Ltd., 205 Yonge St., has applied for grounds at the Island to build a sheet metal building to house boats and to be used as school of instruction. The company will also erect a plant to manufacture air and water boats.

W. H. Mallory, architect, 31 Queen street west, invites tenders on roofing and galvanized iron works in connection with the erection of a store on St. Clair avenue.

Stuart & Foster, Ltd., manufacturing chemists, 361 King E., are considering the erection of a brick warehouse.

Plans are being prepared by F. H. Herbert, 65 Adelaide E., for a new building to replace the Woodbine Hotel, recently destroyed by fire. The specification calls for 10 storeys, steel frame, brick and terra cotta construction, fireproof throughout. Estimated cost $250,000.

S. J. Marchalleck & Co., 44 Yonge St. Arcade, invites bulk tenders on the erection of three solid brick stores on Geary Avenue.

Vancouver, B.C.

A permit for the erection of a store to cost $7,500, has been issued to G. V. Fraser, Shaughnessy Heights. General contractor, M. Hall, 540 56th Ave. E.

Victoria, B.C.

The plans for the Victoria Curling Club rink have been completed by

Coates & Fleet, 28 Winch Bldg. The work is to be done in the summer.

Wallaceburg, Ont.

Plans are being prepared for the erection of a brisk yard for the Wallaceburg Lumber Co., machinery will be required.

Weyburn, Sask.

Tenders for the erection of a store and office building are invited by Frank Moffett, 3rd street. Architects, Radford Arch. Co., New York, N.Y.

Wiarton, Ont.

A by-law has been carried by the ratepayers granting a loan of $25,000 to the Canada Casket Co., for factory erection.

Winnipeg, Man.

The erection of a factory and warehouse on Higgins Ave., is contemplated by the Watkins Medical Co. of Winona, Minn., U.S.A.

Plans are being drawn for a $100,000 Hotel on Logan Ave. and Lizzie St., for Mr. Larson. Architect, D. Abramovitch, 5th floor, McIntyre Block. Tenders will be called for separate trades.

CONTRACTS AWARDED

London, Ont.

The following contracts have been awarded in connection with the erection of a creamery and cold storage plant for Silverwood Ltd., Bathurst street. Architects, Watt & Blackwell, Bank of Toronto Chambers. General contractors, Jno. Hayman & Sons Co., Ltd., 432 Wellington St. Refrigerating machinery, creamery equipment, etc., De La Vergne Machine Co., Ft. 138 th street, New York, N.Y. The contract for plumbing, roofing and painting (white enamel) is still open.

Montreal, Que.

The contract for alterations of and erection of stores on Dorchester St. W. for L. Cohen & Sons, has been let to C. W. Strang, 76 Plymouth Grove.

The contract for the erection of the Ford Motor Car Co. factory has been secured by Touvin & Leghton, Philadelphia, Pa.

The following contracts have been awarded in connection with the conversion of 360 Dorchester St. W. into stores: Carpentry, A. Heaton, 201 University St.; steel, Structural Steel Co., New Birks Bldg.; roofing, Campbell Gilday, 663 St. Paul St.; heating and plumbing, John Watson & Co., 4145 St. Catharine St. W.; electrical, Collyer & Brock, 131 St. Alexander street.

Windsor, Ont.

The following contracts have been awarded on the erection of stores and flats for Jos. Loikrec, 68 Wyandotte E. Architects, Leybourne & Whitney, Sandwich St. E.; masonry, Duncan Clarke; carpentry, W. H. Creber; steel and roofing, Windsor Hardware Co.; plastering, N. Troup, 148 Goyeau St.; painting, P. W. Holloway, 125 Glengarry; heating and plumbing, Alfred L'Heureux, 113 Goyeau St.; electrical, Gas & Electric Supply Co.

Residences

Edmonton, Alta.

Plans for a $100,000 apartment house are being drawn by Van Sichen & Macomber, architects, 314 Alexander Block.

Hamilton, Ont.

Plans are being drawn by W. Grayson Brown, architect, Rm. 204, Clyde Block, for a $125,000 apartment house which will be erected in the south-west portion of the city within the next 12 months.

London, Ont.

Plans for an addition to the residence of Jas. C. Duffield, have been drawn by Watt & Blackwell, Bank of Toronto Chmbrs., estimated cost $9,000.

Montreal, Que., Rosemount

A permit for the erection of flats to cost $12,000 on 3rd Ave., has been issued to H. Dagenais, 342 4th Ave.

Montreal, Que., Westmount

H. A. Adams, architect, New Birks Bldg., Montreal, is now receiving tenders for the erection of a $10,000 residence on Carleton Ave.

The erection of flats on Columbia Ave. is proposed by J. H. Hutchison, 64 St. Ambroise St.

Hutchison, Wood & Miller, Royal Ins. Bldg., Montreal, is inviting tenders on the erection of a $15,000 residence on Redfern Ave.

Montreal, Que.

Recent permits issued include, E. Bissonette, 182 Vitre St., for flats to cost $11,000; W. Archambault, 3797, Clarke St., for flats to cost $5,500; H. Vermette, 2697 St. Laurent St., for flats to cost $7,000; J. Davey, 179 Canning St., for flats to cost $9,000; J. W. Charette, 1821 Esplanade, for flats to cost $10,000; Canadian Vickers, Ltd., 2288 Hutchison, for flats to cost $13,000; and F. Marcoux, 1306 De St. Valier St., for flats to cost $5,000.

Ottawa, Ont.

Plans for a $9,000 residence, on Daly St., for Chas. A. McCool, 445 Wilbrod St., have been drawn by W. E. Noffke, architect, Central Chmbrs., Queen St.

Plans are being drawn for an $8,500 residence for A. M. Davis, 251 Clemow Ave. W. H. George, Castle Bldg., Queen St., is the architect.

Plans for a $25,000 apartment house, on Rideau St., for A. Dworkin, are being drawn by Jas. Mather, 110 Wellington.

The erection of a residence, on Riverdale St., at a cost of $6,000, is proposed by B. A. Grieson, 100 Fentiman St.

Quebec, Que.

A permit for the erection of a $7,000 residence has been issued to Hercule St. Cyr, 59 Bigaouette Ave.

St. John, N.B.

Tenders for the erection of a residence, on Rockland Rd., for T. H. Haley, are invited by the architect, F. Neil Brodie, 42 Princess St.

Toronto, Ont.

Plans for the erection of a [illegible] apartment block on Tyndall Ave., have been drawn by W. H. Charlton, 119 Indian Road.

Plans for the erection of a detached residence on Melgund Rd., have been drawn for M. P. Taling 265 Havelock St. Estimated cost $7,000.

Plans for 2 detached residences on Millbrook Ave., have been drawn by City Home Bldrs., 54 Hogarth Ave. Superintendent, Chas. McLaughlin; estimated cost $10,000.

Tenders on the erection of a duplex residence on Balmoral Ave., are invited by J. A. Thatcher, 31 Queen St. W.

Tenders on the erection of a residence, in Lawrence Park, are invited by the architect, E. A. Yeigh, 156 Yonge St.

Vineland, Ont.

Tenders for the erection of a $5,000 residence, are invited by W. B. Rittenhouse. Joseph Daw, 165 St. Paul St., St. Catharines, is the architect.

Whitby, Ont.

Tenders on the erection of a 2½-storey brick and stone residence are being received by J. Francis Brown, Board of Trade Bldg., Toronto.

Windsor, Ont.

The erection of a residence on Glengarry St., at a cost of $5,000, is being considered by Nathan Cohn. C. Jacques & Co., Boug Block, is the architect.

Winnipeg, Man.

A permit for the erection of an apartment block, to cost $45,000, has been issued to J. Vogel, 610 McIntyre Block.

Plans are in progress for the erection of a $60,000 apartment block, on Mountain and Powers Sts., for Levy Bros., 241 Portage Ave. The architect is A. Abramovitch, 219 McIntyre Block.

A permit for the erection of an apartment block, on Henry and Martha Sts., have been issued to M. R. Diner, estimated cost $28,000. Architect, M. Blankstein, 450 Dufferin Ave. General contractor, A. Black, Cobourg and Counter.

McCrae & McKenzie, McIntyre Blk., are considering the erection of a rooming house, at a cost of $100,000.

Work on the $50,000 apartment block, on Nassau and John St., for Mr. Noble is to start at once. Architect, D. Abramovitch, 5th Floor, McIntyre Block.

Tenders will be received by the Board of Control up to April 28th, for the erection of a residence for the Medical Supt., Fort Rouge. Architects, Ross & MacDonald, 106 Tribune Bldg.

Winnipeg, Man., Transcona

Mr. Neil, Tribune Bldg., contemplates the erection of a number of residences. Work on which is to start shortly.

CONTRACTS AWARDED

London, Ont.

J. A. Stanley, 1053 Richmond St., has secured the contract for the erection of a residence on Richmond St., for J. D. Walters.

Montreal, Que.

The contract for masonry in connection with the alterations and additions to the Lincoln Ave. property of J. S. Prince, has been let to Church, Ross & Co., 22 St. John St., the other contracts will be awarded shortly.

The contract for masonry connected with the erection of Walter E. Lyman's residence on Redpath Crescent, has been let to Fussing & Jorgensen Bros., Westmount Blvd.

The contract for the erection of an apartment house on Durocher St., for A.

Continued on page 82

Tenders and For Sale Department

CITY OF LONDON, ONTARIO

Tenders for Sewer Construction

Sealed tenders, addressed to the City Clerk, will [illegible] Thursday, May 7th, 1914 [illegible] the following works:

[illegible] Street Section, Storm and Sanitary Sewer.

Contract 2.—Adelaide Street Section, Storm Sewer only.

Contract 3.—Colborne Street Section, Storm Sewers only.

Contract 4.—Ridout Street Section, Storm Sewers only.

Contract 5.—Wharncliffe Road Section, Storm Sewers only.

Plans and specifications may be seen at the City Engineer's office, London, or at the office of the Consulting Engineers, Mail Building, Toronto, on and after April 10th, 1914.

The lowest or any tender not necessarily accepted.

C. M. R. GRAHAM, Esq., Mayor.
WM. N. ASHPLANT, City Engineer.
CHIPMAN & POWER, Engineers.

14 and 16

City of Regina

Sewers

Sealed tenders addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, **May 12th, 1914**, for the following materials and work:—

(A) Supply and delivery of approximately:—
50,000 lin. ft. of 6-in. sewer pipe.
57,000 lin. ft. of 8-in. sewer pipe.
7,000 lin. ft. of 9-in. sewer pipe.
600 lin. ft. of 10-in. sewer pipe.
6,000 lin. ft. of 12-in. sewer pipe.
10,250 lin. ft. of 15-in. sewer pipe.
6,000 lin. ft. of 18-in. sewer pipe.
3,000 lin. ft. of 20-in. sewer pipe.
8,000 lin. ft. of 24-in. sewer pipe.
258 lin. ft. of 36-in. sewer pipe.
672 lin. ft. of 39-in. sewer pipe.
336 lin. ft. of 42-in. sewer pipe.
753 lin. ft. of 45-in. sewer pipe.
336 lin. ft. of 48-in. sewer pipe.
840 lin. ft. of 54-in. sewer pipe.
2,230 lin. ft. of 60-in. sewer pipe.
1,400 No. 6-in. off 8-in. x 2-ft. tees.
200 No. 6-in. off 9-in. x 2-ft. tees.

(B) Supply and delivery of approximately:—
[illegible]

(C) Supply and delivery of approximately:—
346 Manhole covers and frames.

(D) Supply and delivery of approximately:—
3,325 manhole steps.

(E) Supply and delivery of approximately:—
6,000 lbs. oakum.

A copy of plans and specifications and all necessary information will be furnished to intending bidders upon the receipt of a marked cheque for Twenty-five Dollars ($25), made payable to the City of Regina.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The City reserves the right to divide each of the works into two or more contracts, and to reject any or all tenders.

R. MARTIN, Mayor.
L. A. THORNTON,
A. W. POOL, City Commissioners.
F. McARTHUR, City Engineer.

15-16

Separate sealed tenders, addressed to the undersigned, will be received at this office until 4 p.m. on **Monday, April 27, 1914**, for the supply of "Brooms and Brushes," "Chain," "Hardware," "Hose," "Oils and Greases," "Packing," "Paint, Paint Oils, etc.," "Manilla Rope," "Wire Rope," and "Steam Pipe, Valves and Fittings," for the departmental dredging plant in Ontario and Quebec.

Each tender must be sent in a separate envelope and endorsed "Tender for Hardware, Ontario and Quebec," "Tender for Chain, Ontario and Quebec," etc., as the case may be.

Tenders will not be considered unless made upon forms furnished by the Department and in accordance with conditions contained therein.

Combined specification and form of tender can be obtained at this Department and at the offices of A. E. Dubuc, Esq., District Engineer, Montreal, Que.; J. E. Sing, Esq., District Engineer, Toronto, Ont.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for the amount mentioned in the tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
—55673. Ottawa, April 6, 1914. 15-16

Sealed tenders, addressed to the undersigned, and endorsed "Tender for addition and alterations to the Public Building, Ingersoll, Ont.," will be received at this office until 4 p.m. on **Wednesday, April 29, 1914**, for the construction of the aforesaid additions and alterations.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the Postmaster, Ingersoll, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, April 7, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—59106. 15-16

TOWN OF ESTEVAN

Province of Saskatchewan

Notice to Contractors

Sealed tenders endorsed on envelope "Tender A," "Tender B," etc., as the case may be, will be received by the Secretary-treasurer until 8 p.m. on **Saturday, May 9th, 1914**, for the following works:—

Contract "A"—Laying Watermains and sewer pipes (approximately 10,500 feet of watermains and 16,000 feet sewer pipe).

Contract "D"—Furnishing cast iron water pipe and specials.

Contract "E"—Furnishing fire hydrants and gate valves.

Contract "F"—Furnishing sewer pipe and junctions.

Plans, specifications and forms of tender may be seen at the Town Engineer's office, Estevan, Sask., or at the office of the "Canadian Engineer," Winnipeg, on and after April 10th, 1914.

Complete set of specifications, etc., but not plans, will be sent to contractor on receipt of Five ($5.00) Dollars, which amount will be refunded on return of such.

The lowest or any tender not necessarily accepted.

JAS. A. SMITH, Mayor,
P. J. STEPHENS, Sec.-Treasurer.
H. V. ARMSTRONG, Town Engineer.

14-16-17

Tenders for Dredging

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dredging, Goderich," will be received at this office until 4 p.m., **Tuesday, April 28, 1914**, for dredging required at Goderich, Ontario.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specifications and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of the filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, April 14, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—59455. 16

Town of Simcoe

Tenders will be received by the Clerk of the Town of Simcoe for Contract "B" for laying branch sewers and constructing manholes, together with the laying of house connections to the street line. The work will be about four miles long. Tenders will be received up to and including **April 30th, 1914**.

Plans and specifications can be seen at the office of the Town Clerk, Simcoe, Ont.

No tender necessarily accepted.

GEORGE WILLIAMSON, Mayor.
W. C. McCALL, Clerk.
April 15, 1914 16

CITY OF HULL

Steam Pumps For Sale

Offers will be received by the undersigned until **May 4th, 1914**, for the purchase of second-hand pumps and boilers:—

Two one million gallon "Knowles," and

Two one million gallon "Blakes" pumps, with necessary valves and connections.

Offers may be made for the four or only one pump.

Each bid must be accompanied by an accepted cheque for a sum equal to ten per cent. of the amount of same.

The highest or any offer not necessarily accepted.

J. P. A. LAFOREST,
16 City Engineer.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Port Hope, Ont.," will be received at this office until **4** p.m. on **Monday, May 11, 1914**, for the construction of Harbour Improvements at Port Hope, Durham County, Ontario.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the office of Mr. J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont., and on application to the Postmaster at Port Hope, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an ac[illegible] lic Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to [illegible] be not accepted the cheque will be returned.

[illegible] the lowest or any tender.

[illegible] Department of Public Works by depositing an [illegible] payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid

By order,

R. C. DESROCHERS,
[illegible]

[illegible]
Ottawa, April 11th, 1914

[illegible] tisement if they insert it without authority from [illegible] 16-17

City of North Battleford

Province of Saskatchewan

Waterworks Dept.

Sealed tenders will be received by the City Commissioners up till noon, **Monday, May 4th, 1914**, for the supply and delivery, freight and duty paid North Battleford, of the following:—

Contract D-2, Lead Pipe and Galvanized Iron Pipe.

Contract D-3, Brass Goods and Curb Boxes.

Contract D-4, Water Meters.

Full particulars may be had at the office of the City Engineers at North Battleford.

The lowest or any tender not necessarily accepted.

J. A. FOLEY, Esq., Mayor.
H. W. DIXON, Esq., City Clerk.
CHIPMAN & POWER, [illegible] 16

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received at the office of the undersigned, up to noon of **Friday, May 1st, 1914**, for the construction of a steel highway bridge with concrete piers and abutments over Bolton Creek in the Township of Bathurst, and one reinforced concrete arch bridge over the Indian River, in the Township of Ramsay, both in the County of Lanark, Ont.

Drawings, specifications, form of tender, and full information may be obtained at the office of the undersigned, Carleton Place, Ont.

Each tender must be accompanied by a marked cheque made payable to the Treasurer of the Municipal Corporation of the County of Lanark for 5 per cent. of the amount of tender, which amount will be forfeited if the party tendering declines to enter into the contract or if the successful tenderer fails to complete his contract in accordance with the tender.

The lowest or any tender shall not necessarily be accepted.

B. G. MICHEL, C.E.,
Engineer.
Carleton Place, Ont.,
April 18th, 1914. 16

City of Moose Jaw

Tenders for Sewer Pipe, Cast Iron Pipe, Valves and Hydrants

Sealed tenders, endorsed "Tender for Tile Pipe," or "Cast Iron Pipe," or "Valves and Hydrants," addressed to the City Commissioners, Moose Jaw, will be received up to 10 a.m. on **Wednesday, May 6th, 1914**, for the supply and delivery f.o.b. Moose Jaw, of the following:—

Contract No. 82. For the supply of 115,000 feet of sewer tile pipe, from 4 to 36 ins. in diameter.

Contract No. 83. For the supply of 1,120 tons of cast iron pipe and 55 tons of special castings.

Contract No. 84. For the supply of 72 6 in. gate valves, 57 8 in. gate valves; 8 10 in. gate valves, 40 12 in. gate valves and 83 fire hydrants.

Specifications and all further information may be obtained at the City Engineer's office.

Each tender must be accompanied by a marked cheque payable to the City Treasurer, for five (5 p.c.) per cent. of the amount of the tender.

[illegible]

JAMES PASCOE,
[illegible]
W. F. HEAL,

Dated at Moose Jaw,
[illegible] 1914 15-16

Bridge Tenders

Sealed tenders will be received by C. H. Stiver, Esq., Unionville, up to noon on **Friday, May 1st**, for building the following work near Locust Hill for the Township of Markham.

(a) Alternative tenders for a 70-ft. steel bridge with concrete abutments, or a concrete arch with suspended floor for the Cedar Grove bridge.

(b) Concrete abutment for Box Grove steel bridge.

For plans, etc., apply to:

C. H. STIVER, Unionville, Ont.
BOWMAN & CONNOR,
16 [illegible]

VILLAGE OF JARVIS

Road Contract

Sealed tenders addressed to the Reeve and delivered, or mailed to reach him not later than **the 28th of April, 1914**, will be received by the Village of Jarvis for the construction of 10,624 square yards of "Tarvia filled" or "Rocmac" macadam roads.

Tenders must be accompanied by a marked cheque payable to the Village Treasurer for five per cent. of the amount of the tender.

Specifications for the work and instructions to bidders may be seen at the offices of the Contract Record and of the Canadian Engineer, Toronto, or at the office of the undersigned at Temple Building, Brantford.

Lowest or any tender not necessarily accepted.

ALAN MAIR JACKSON,
15-16 Village Engineer.

CITY OF BERLIN

Tenders for Creosoted Wood Block Pavement

Sealed tenders addressed to A. H. Millar, City Clerk, will be received up to 5 o'clock p.m., April 30th, 1914, for approximately 21,422 sq. yards of Creosoted Wood Block Pavement in the City of Berlin. Plans and specifications may be seen at the office of the "Contract Record" and "Canadian Engineer," Toronto, and at the office of the City Engineer. The lowest or any tender will not necessarily be accepted. 15-17

HERBERT JOHNSTON,
City Engineer.

Corporation of the Town of Pointe Claire

Pointe Claire, P.Q.

Tenders for Roads

Sealed tenders addressed to the Secretary-Treasurer and endorsed "Tender for Road Construction," will be received at the office of the Corporation at Pointe Claire until 12 noon on **Wednesday, May 6th, 1914**.

Plans, specifications, form of tender, and full information will be furnished on application to the undersigned on or after April 15th, 1914.

A deposit of $20 will be required before plans and specifications will be given out, which will be refunded on their return in good condition.

The lowest or any tender not necessarily [illegible]

G. C. ANDERSON,
[illegible]

Pointe Claire, Que. 15-16

Church Tenders

[illegible] for all [illegible], except heating, plumb- [illegible] work for the proposed Rectory and [illegible] of the [illegible] of the Immaculate Con- [illegible] will be received until 5 p.m., **Wednesday, May 6th.** Plans and specifications may be seen at the Rectory, St. Peter's Cathedral, Peterborough, and also at the office of the architect.

A. W. HOLMES,
10 Bloor Street East,
16 Toronto, Ont.

Greater Winnipeg Water District

To Contractors

Tenders for Construction of Dyke

Sealed tenders (marked "Tender for Dyke"), addressed to the "Commissioners of the Greater Winnipeg Water District, 901 Boyd Building, Winnipeg," will be received up to noon of **Friday, May 15th, 1914**, for the construction of a dyke across the end of Indian Bay (an arm of Shoal Lake, Ontario). The dyke will contain about 220,000 yards of fill.

Information for bidders, specifications and form of tender and plan will be obtainable, and the form of contract will be on view, at the office of the Commission after Monday, March 30th.

The lowest or any tender not necessarily accepted.

Greater Winnipeg Water District,
S. H. REYNOLDS,
Chairman of Commissioners.
Winnipeg, March 24, 1914. 15-16

Department of Railways and Canals, Canada

Hudson Bay Railway Terminals
Port Nelson, Man.

Sealed tenders, endorsed "Tender for Provisions" or "Tender for Hardware Supplies," as the case may be, will be received by the undersigned, up to 16 o'clock **Tuesday, May 5th, 1914**, for the furnishing of the above, to be delivered in such quantities at Halifax, N.S., and at such times as may be directed.

Dealers may tender for the total quantities required, or for such portions thereof, as may suit their convenience.

Specifications of requirements, and full information can be obtained from the Purchasing Agent of the Department of Railways and Canals, Ottawa, on and after this date.

Accepted bank cheque for $1,000 and $500 respectively, made payable to the order of the Minister of Railways and Canals must accompany each tender, which sums will be forfeited if the party tendering declines entering into contract for supplying any of the goods awarded to him, or in any way fails to properly fulfill the same.

The cheque thus sent in will be returned to the respective tenderers whose tenders are not accepted.

The lowest or any tender not necessarily accepted.

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, April 20th, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—59816. 16-17

Notice to Contractors

Sealed tenders will be received by the undersigned, up to and including **May 2nd, 1914**, for the erection of the Kintore Presbyterian Church, according to the plans and specifications. Tenders to be either for the whole contract, or for part thereof. The lowest or any tender not necessarily accepted. Plans and specifications can be seen at the following places: Journal Office, St. Marys; William Crellin's Store, Kintore, and at the office of Wm. J. Murray, Architect, London, Ont.

GEO. B. ANDERSON,
Secretary, Building Committee,
16-17 R. R. No. 1, Lakeside, Ont.

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by Freeman Campbell, Esq., Chairman of Committee, Randall, Ont., up to noon of **Thursday, May 7th, 1914**, for the construction of concrete abutments and concrete floor for a steel bridge over the Nottawasaga River between the Townships of Essa and Tecumseh in the County of Simcoe known as the Nicholston Bridge.

Plans, specifications and all necessary information may be seen at the office of R. H. Jupp, County Engineer, Orillia, and at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Consulting Engineer,
Toronto, April 21, 1914. 16

Town of Kamsack
Province of Saskatchewan

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 2 p.m., **Wednesday, May 13th**, for the following works:—

Contract "A"—Labor, laying Water Mains and Sewers.
Contract "B"—Power House and Filter House.
Contract "C"—Furnishing Materials for, and Erecting Water Tower.
Contract "D"—Furnishing Cast Iron Water Pipes.
Contract "E"—Furnishing Fire Hydrants and Valves.
Contract "F"—Furnishing and Installing Pressure Filters.
Contract "G"—Furnishing and Installing Pumping Machinery.
Contract "H"—Furnishing and erecting Boilers.
Contract "J"—Furnishing and erecting Steam Engine.
Contract "K"—Furnishing and erecting Generator.
Contract "R"—Labor and Material for construction of Concrete Reservoir.
Contract "S"—Furnishing Sewer Pipe.
Contract "T"—Construction of Concrete Walk.
Contract "X"—Labor and Material for construction of Sewage Disposal Works.

Alternative bids will be received for Gas Producers, and Engines in place of Boilers and Steam Engine, of same capacity.

Plans and specifications may be seen at the office of the Engineers, Toronto and Winnipeg, and at the Town Hall, Kamsack.

No tender necessarily accepted.

E. J. JOHNSON, Esq., Mayor,
Kamsack, Sask.
A. A. CRAWFORD, Esq., Sec.-Treas.,
Kamsack, Sask.
CHIPMAN & POWER, Engineers,
16-17 Toronto and Winnipeg.

VILLAGE OF TOTTENHAM

Tenders
for
Waterworks System

Sealed tenders addressed to the Clerk, Tottenham, Ont., will be received on or before **8th day of May, 1914**, for the supply and erection of water tanks, cast iron or steel watermains, hydrants, valves, etc., laying water mains and supplying and erecting pumps and engines and reinforced concrete storage basin.

Plans and specifications and form of tender may be seen at the office of the engineers, Messrs. James, Loudon & Hertzberg, 79 Adelaide Street East, Toronto, or the office of A. P. Potter, Tottenham, Ont.

A. P. POTTER, Reeve.
April 22nd, 1914. 16

Positions Wanted

To Architects.—Superintendent of works is open for re-engagement. Familiar with all kinds of office buildings, schools, banks and hospitals. Ready to take charge of works at once. Reply "Superintendent," Contract Record, Toronto. 15-16

Agents Wanted

Large British firm manufacturing water level indicators and other municipal engineering equipment, wants representatives in Eastern Canada, Middle West and Far West. Apply Box 10, Contract Record & Engineering Review, Toronto. 16-19

Contractors' Outfit For Sale

Suitable for Sewer and Water Works Construction One Parsons Trenching Machine, Concrete Mixers, pumps, trench braces and other tools, being a complete outfit.

Can be seen at Prince Albert, Sask., Canada. Information, write

HUGO & TIMS COMPANY,
14-17 Duluth, Minn.

Town Engineer Wanted

Town of Sudbury, Ontario

Applications will be received by the undersigned until 6 p.m., **Saturday, April 25th, 1914**, for the position of Consulting Engineer for the Town of Sudbury, on a salary basis and percentage, for paving and other work to be done during 1914.

Applicants will please state experience, when available, salary and percentage required.

W. J. ROSS, Town Clerk.
Dated at Sudbury,
This 7th day of April, 1914. 15-16

Public Notice

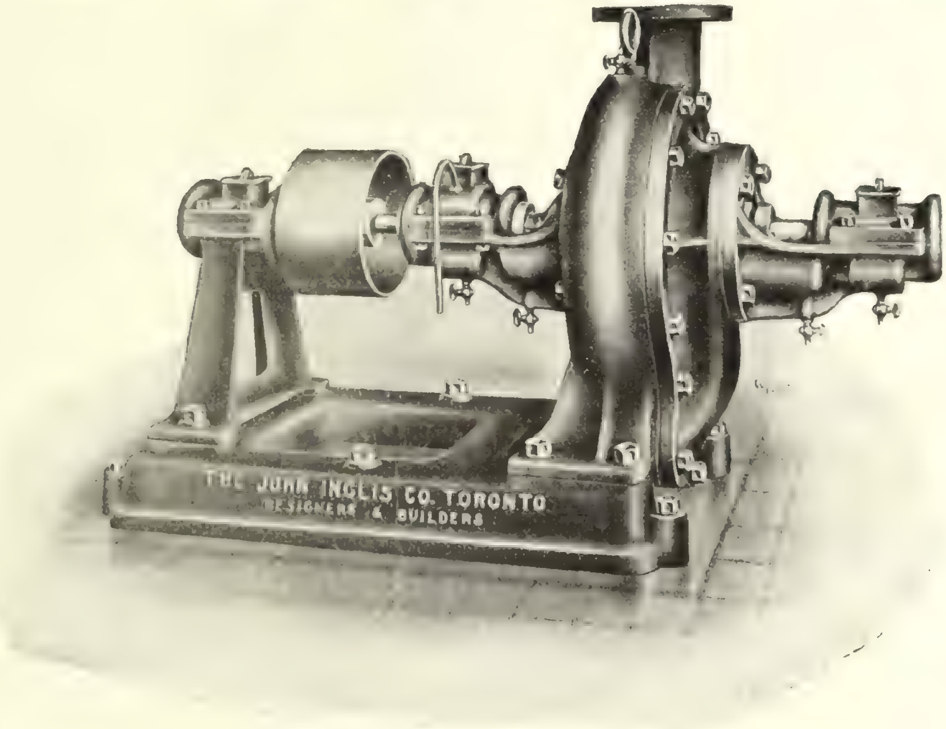
Re Position of Asphalt Superintendent

Applications addressed to the Chairman and Members of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control, up to 4 p.m., **Tuesday, April 28th, 1914**, for the position of Asphalt Superintendent and Inspector. Said Superintendent is to be able to make asphalt analysis and to be thoroughly experienced in asphalt work.

Applicants are requested to state their age, experience and salary expected.

ARCH CURRIE,
City Engineer.
Ottawa, April 8th, 1914. 15-16

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

[illegible] A. Caron has been let to G. Meloche, 276 St. Viatur St.

Montreal, Que., Notre Dame de Grace

The following contracts have been awarded on 12 residences for Chas. Fyfe, 137 Park Ave. Masonry and brick, Geo. Martin, [illegible] McGill St. Heating and plumbing, Jas. B. Staton, 5410 Sherbrooke W. The other contracts will be awarded shortly.

The [illegible] contract on 50 cottages being erected on West Hill Ave. by Henry Gaffney, 204 St. James St., has been let to Powell & Co., 235 St. Urbain St., Montreal.

Ottawa, Ont.

The contract for masonry in connection with the erection of Mr. G. F. Hodgkin's residence on O'Connor and Linden Sts., has been awarded to Holbrook & Sons, 425 Somerset St. The carpentry will be done by day labor and other trades are not yet let.

The following sub-contracts have been awarded in connection with the erection of a residence on Centre St., for Adamson & Robertson, 126 Sparks St. Plastering, Sutherland & Son, Cooper St. Painting, W. J. Carson, 293 Laurier W.

The contract for the erection of apartments on Lisgar St., for C. Howard Putman, has been secured by Johnston & Whiteby, 10 Oakland.

Toronto, Ont.

The contract for the erection of a detached residence on Walmer Rd., for T. A. Hiam, has been let to Geo. C. Briggs, 499 Ossington Ave. The roofing, plastering, painting, heating, plumbing and electrical is to be sublet.

Toronto, Ont., York Mills

The contract for the erection of Rev. C. A. Myer's residence, has been secured by Palmer Bldg. & Contracting Co., McKinnon Bldg., Toronto.

Power Plants, Electricity and Telephones

Calgary, Alta.

The ratepayers will vote on a by-law April 30th, to raise the sum of $90,000 for the construction of a concrete sub-base under the street railway, and on the same day authority will be asked for the expenditure of $300,000 on extensions to the electric lighting system. The sum is made up as follows:—Sub-station for Crescent Heights, additional equipment, $30,000; sub-station S.W. Section of city, addition equipment, $30,000; Victoria Park station, equipping high tension, transforming, switching and control station, $70,000; 12,000 volt feeders for sub-stations S.W. Section of city and Crescent Heights, $4,000; line extensions, pole line extensions to light and power distributing systems, $60,000; meters and transformers, service meters and transformers for present system and extensions, $45,000; street lighting, lights, equipment and labor, $20,000; underground cable and accessories, $31,000; engineering and contingencies, $10,000.

Camrose, Alta.

The by-law providing for electric light extensions has been passed by the municipal council.

Edmonton, Alta.

The by-law providing for $120,693.33 for electric light and power extensions, and $61,320 for telephone extensions has been passed by the city council. The work will be done this summer.

Embro, Ont.

The ratepayers are to vote on the hydro power by-law on April 24th.

Hamilton, Ont.

The congregation of St. Lukes English Church has decided to install electric lighting system.

Kelowna, B.C.

Additions to the light and power plant, involving a cost of $55,000, are contemplated by the municipal council.

Lake Megantic, Que.

Plans for the installation of a hydro-electric plant, at a cost of $150,000, have been prepared and accepted by the municipal council. Engineer-in-charge, E. A. Evans, 92 St. Peter St., Quebec.

Medicine Hat, Alta.

Additions to the electric lighting system are being considered by the city council, and ornamental posts will be placed 100 ft. apart in the business section.

Ottawa, Ont.

Additions to the electrical station on Laurier St. E., are proposed by the city council, for which new machinery will be required.

Sudbury, Ont.

Wm. H. Owens, 18 Baikie-Gill Block, wishes quotations on 2 elevators, for an office building, to be driven by electric power, having a lift of aproximately 42 ft. from basement to 2nd storey ceiling. Corner guides to be used. Maximum capacity 1 ton. Machinery located in basement. Speed about 20 ft. per minute. Size of car 5 ft. square. Steel guides preferred. Open car and gates at 4 openings. Alternating current to be used 220 volt, 2-phase, 60-cycle.

Swift Current, Sask.

Tenders will be received by the Town Clerk, G. D. Arnott, until April 28th, for the completion of the power house.

Tillsonburg, Ont.

The municipal council is about to purchase a new electric pump for the power house.

Windsor, Ont.

The Hydro-electric Commsn., chairman, D. Bowlby, 322 Sandwich St. W., is about to purchase 2,000 cedar poles, 25 ft. to 50 ft. long.

Woodbridge, Ont.

The ratepayers have voted to issue debentures for $6,000 for hydro power purposes.

CONTRACTS AWARDED

Khedive, Sask.

The telephone line contract has been secured by H. D. Craig, Box 476, Regina.

Regina, Sask.

The following contracts for telephone lines have been awarded by the Prov. Govt. Dept. of Telephones. Lumsden-Watrous, R. & M. McLeod, Winnipeg; Gull Lake-Maple Creek, S. L. Ross, 1951 Rose St., Regina; Forward-Ogema, W. D. Craig, 2276 Cornwall St., Regina; Nokomis-Semans, G. T. Brander, Wolseley, Sask.; Lampman-Estevan, Houston, Tallman & Co., Regina.

Winnipeg, Man.

The Board of Control has awarded a contract to the Canadian Bridge Co., Walkerville, Ont., for the construction of steel grillages for footings for the towers on transmission line at $9.75 each.

Miscellaneous

Calgary, Alta.

A by-law providing for the installation of a police patrol signal system, at a cost of $12,000, will be submitted to the ratepayers on April 30th, when sanction for the expenditure of the following items will be asked: Site and fire station, Glengarry, $4,500; fire station, Elbow Park, $5,000; fire alarm extension, $4,000; equipment, $15,000; contingencies $1,500.

Hamilton, Ont.

The National Natural Gas Co. will call tenders in about a month for gas mains, valves, junctions, Y's, etc.

London, Ont.

The Egerton St. Baptist Church are about to purchase a gymnasium equipment.

Medicine Hat, Alta.

Tenders will be called shortly by the city council for 1 or 2 combination fire hose and chemical trucks, motor driven, 6-cylinder single chemical tank.

Ottawa, Ont.

Tenders will be received by Alex. Johnston, Dept. Marine & Fisheries, until May 14th for steel single screw hopper barge to be delivered at Sorel Que. Plans, etc., are at the office of the Dept.

CONTRACTS AWARDED

Edmonton, Alta.

A contract has been awarded by the city council to the Edmonton Iron Fence & Wire Co., for the construction of a wire fence for the sidewalk handrails on the high level bridge.

Galt, Ont.

The following contracts have been awarded by the town council. Cement, Scott & Hogg, Water St. S., 500 bbls.; cement, J. D. Burns, Main St., 500 bbls.; hardware, Fraser Hardware Co., Dickson St.; lumber, Galt Lumber Co., Ainslie St.; castings, etc., Stevens Foundry Co., Rose Street.

Kingston, Ont.

The following contracts have been awarded by the city council. Sewer pipe, Hamilton & Toronto Sewer Pipe Co., Ltd., 77 York St., Toronto; cement, Frontenac Lumber & Coal Co., Ontario street.

Quebec, Que.

The following contracts for supplies have been awarded by the city council. Drain pipes, Standard Clay Products, St. James St., St. Johns, Que.; cement, A. R. Preneau & Co., Quebec; brick, A. Paradis, Quebec; brass, British Export Mfg. Co.; iron, Terreaut Racine & F. X. Drolet, Quebec; lead pipe, Jenkins Bros., Ltd., St. Remi, Montreal; pig lead, Thos. Robertson & Co., Ltd., 134 Craig St. W., Montreal.

Winnipeg, Man., Transcona

A contract has been awarded by the Transcontinental Rly. Commrs., to The A. B. Ormsby Co., Ltd., King St. W., Toronto, Ont., for the construction of a shavings and sawdust exhaust system for the car shops plant.

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving **would have enriched your treasury approximately a** quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

220 King Street West, Toronto

Gravity System Distributing Concrete

Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.

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B. C.

Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
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All Steel Wheelbarrow

The "Erie" line of wheelbarrows includes every type required by the contractor. Made with trays of welded steel 18, 16 or 14 gauge to hold 3, 4 or 5 cubic feet of material.

The barrow illustrated has forward dump and wheel guard. The handle is strong and well braced. The legs are of channel steel.

Write us for prices, etc.

The Erie Iron Works, Limited
St. Thomas, Ontario

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
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Toronto Ontario

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J. & J. Taylor
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Established 1855 TORONTO
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Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

HUMBER BRICK YARDS
Lime, Sewer Pipe and Fire Brick

JOHN MALONEY
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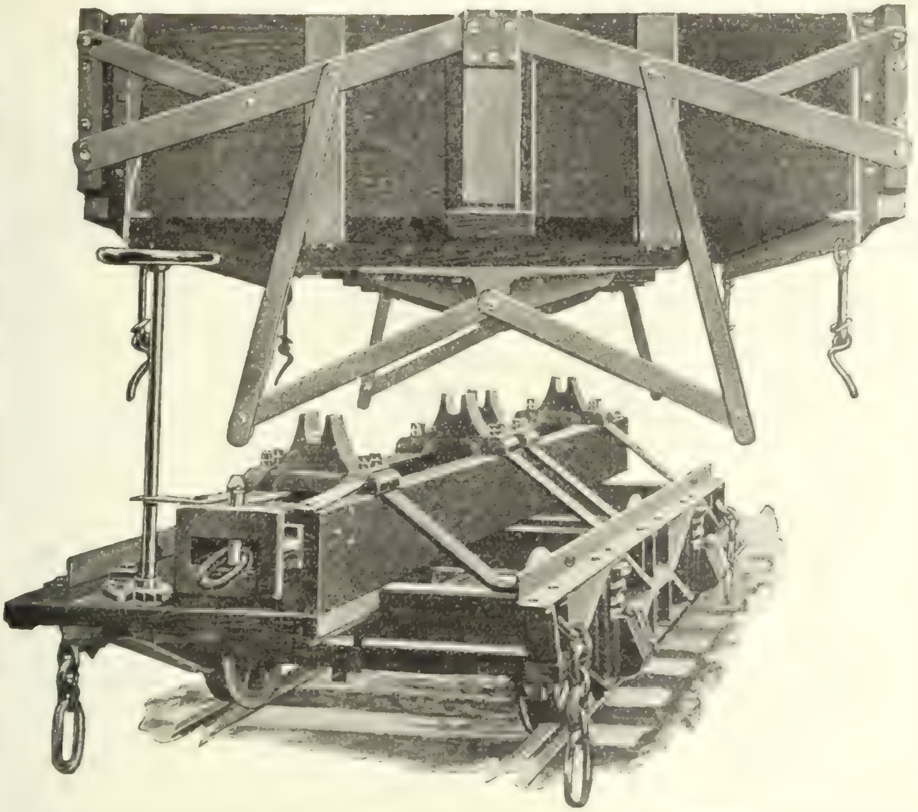


Cut showing 4 and 6 yard Double Diamond Steel Frame Car showing how easily they are handled

GLENGARRY

This is a Clean Lift

The feature which all our cars possess, of being able to be handled like this when loading or unloading, or for putting back on track if a run-off should occur, is one which should appeal to a practical man. The entire box and dumping irons are removable immediately as shown, making less hard work and lifting. Cars are easily transported this way. No pins to loosen up or stick. The carrying bar is held fast and drops into place easily.

This is a feature which has been much appreciated.

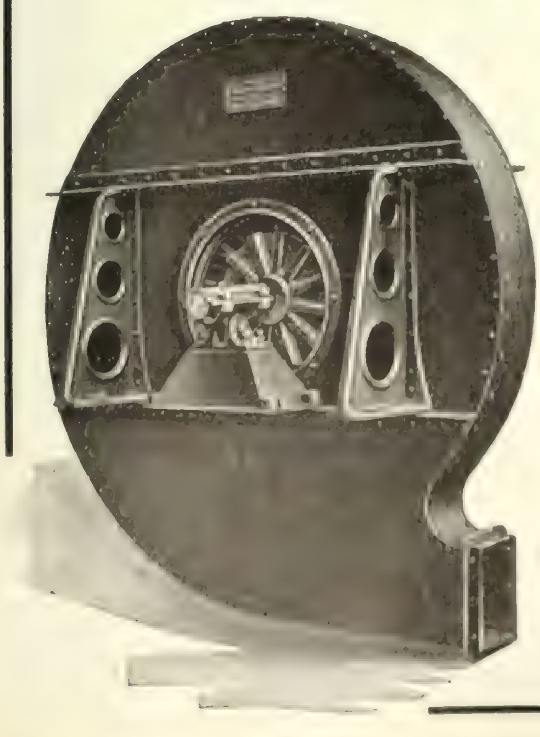
The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

---

Your Cupola — Are You Giving it a Fair Chance?

Is it assisted by a Blower that provides for perfect combustion of the fuel?
Does it produce sufficient pressure to overcome the resistance within the cupola?

"Sirocco" TRADE MARK **Special Steel Pressure Blowers**



do these all-important things and at a lower cost for power than blowers of other types or even of the same type. There are no frictional surfaces to "eat up" power in a "Sirocco" Blower. The bearings are self-aligning and self-oiling. Being independent of the housing prevents vibration. The speeds of "Sirocco" Blowers are adaptable to direct connection to electric motors and steam turbines, thereby eliminating the usual belt and gear power losses.
Every ounce of energy put into a "Sirrocco" Special Steel Pressure Blower goes to **propelling air.**

Write for Bulletin No. 8. It contains helpful information on Pressure Blowers

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W. F. EDDY
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Winnipeg

[illegible] CLARKE
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TORONTO IN LAST SIX YEARS HAS SPENT 40 MILLIONS MORE ON BUILDINGS THAN ANY OTHER CANADIAN CITY

No other city on the continent has grown so rapidly as Toronto during the last few years. Not only in population has the city expanded beyond comparison, but an illustration of the enormous building which has gone on is given in the fact that during the six years ending with December 31, 1913, building permits were issued to the value of $129,582,190.

In every year during that period, Toronto led the other cities of the Dominion, and the nearest approach to its wonderful record is given in Montreal's totals, which reached $89,682,545. The Western cities made a fairly good showing, with Winnipeg heading the list at $86,758,625, Vancouver second at $73,731,600, followed by Calgary at $50,938,197, and Edmonton at $35,225,498.

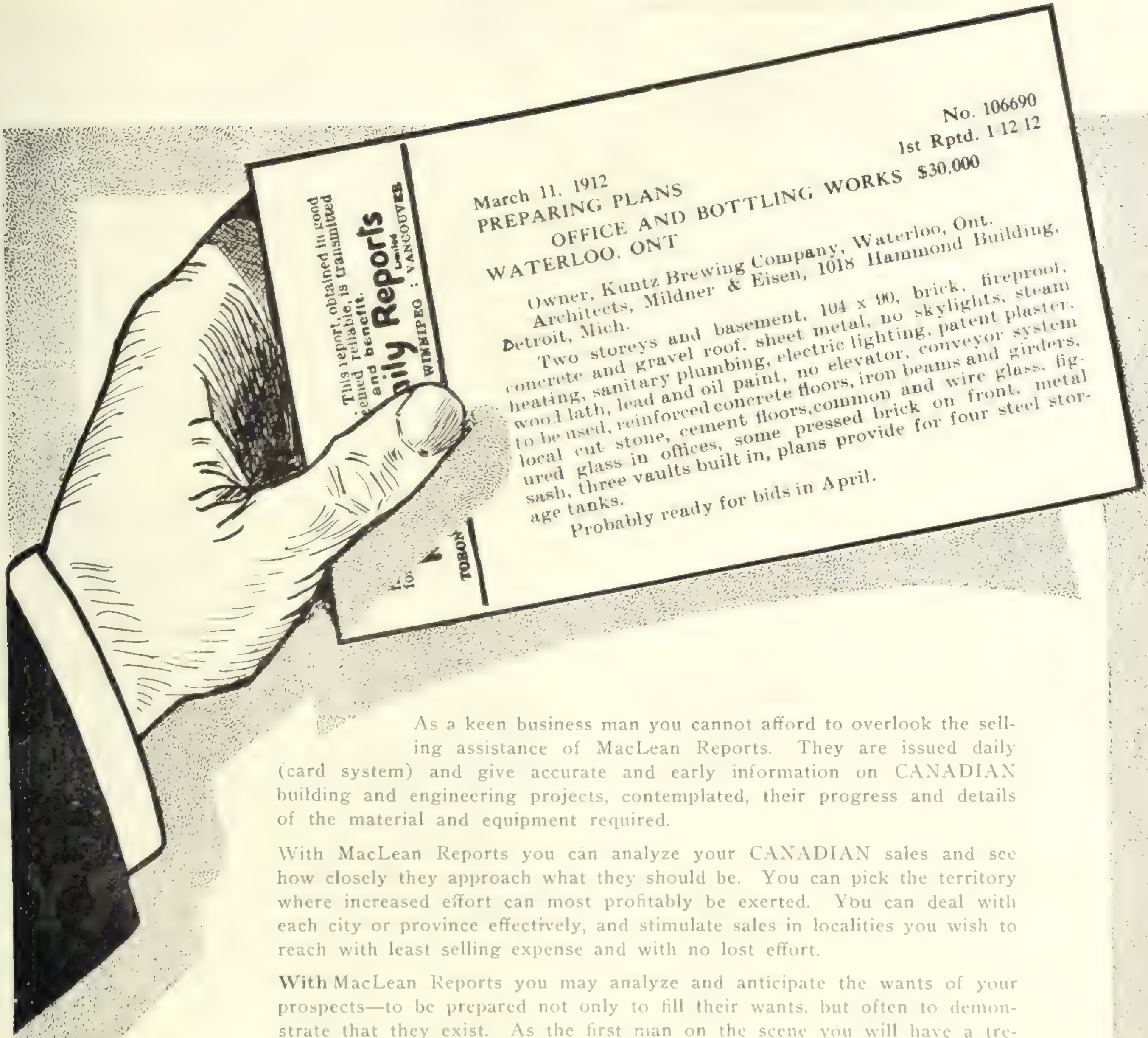
As the table will show, Toronto was not affected by the handicap of lack of funds for building operations last year, and while there was no increase over the previous year, it did not show the heavy declines of the Western centres.

BUILDING PERMITS DURING THE LAST SIX YEARS:

25 Eastern Cities—	1913	1912	1911	1910	1909	1908
Toronto	$27,038,624	$27,041,761	$24,374,539	$21,127,783	$18,154,047	$11,795,436
Montreal	27,032,097	19,408,690	14,579,952	15,815,859	7,783,621	5,062,326
Hamilton	5,110,000	5,491,800	4,255,730	2,604,605	1,623,100	1,394,457
Ottawa	3,991,380	3,621,850	2,997,610	3,022,650	4,527,590	1,794,075
Fort William	4,265,715	4,039,600	3,077,860	2,381,125	2,970,365	1,560,835
Maisonneuve	2,454,923	2,685,828	1,195,120	928,960	1,200,500	....
St. John	2,380,660	566,200	572,700	524,475	375,300	270,150
Westmount	2,009,544	1,824,369	1,435,682	1,974,670	1,417,600	....
Port Arthur	1,935,185	2,494,179	595,180	892,681	500,000	293,000
Quebec	1,929,781	933,002	739,423	762,998	711,519	546,248
Outremont	1,819,000	1,582,000	1,317,700	832,900	918,500	....
London	1,789,920	1,136,108	1,038,880	805,074	850,134	464,180
Windsor	1,148,975	988,063	739,515	392,040	431,060	350,000
Brantford	1,015,866	1,167,105	613,860	681,030	439,335	308,155
Halifax	835,850	589,775	508,836	471,140	630,380	857,271
St. Catharines	759,478	811,335	265,435	263,000	238,250	403,705
Kingston	666,474	645,774	314,569	220,092	452,695	170,600
Berlin	647,571	834,213	356,091	347,556	232,365	265,000
Peterboro	488,540	465,905	345,372	517,958	343,489	238,963
Preston	400,055	337,160	244,375	....	85,950	71,000
Guelph	357,335	388,499	513,690	135,700	127,625	331,770
Chatham	338,310	201,591	195,147	61,849	110,610	57,905
Stratford	334,085	439,496	103,532	185,436	158,964	163,607
Sydney	321,198	656,111	495,642	347,554	160,470	68,615
St. Thomas	154,471	89,946	207,415	202,000	261,600	219,300
Total	$89,224,057	$78,340,360	$61,083,355	$57,498,955	$44,705,069	$26,685,598
15 Western Cities—						
Winnipeg	$18,621,650	$20,563,750	$17,716,750	$15,116,450	$9,226,325	$5,513,700
Vancouver	10,248,803	19,420,432	17,652,642	13,150,365	7,258,565	5,950,893
Edmonton	9,242,450	14,446,810	3,672,260	3,159,106	2,155,016	2,549,847
Calgary	8,619,153	20,394,220	12,907,638	5,580,594	2,432,072	1,[illegible]04,520
Saskatoon	4,453,845	7,640,530	4,960,286	2,817,771	942,905	[illegible]15,625
Moose Jaw	4,238,470	5,275,797	2,413,736	1,071,090	1,107,500	450,925
Victoria	4,037,992	8,208,155	4,026,315	2,273,045	1,673,420	1,130,740
Regina	4,018,350	8,047,309	5,099,340	2,351,238	744,479	476,654
Medicine Hat	3,851,572	2,836,219	743,272	205,639	228,168	153,172
Prince Albert	1,380,290	2,042,450	921,595	662,475	300,000	200,000
St. Boniface	1,038,840	1,251,512	1,131,735	861,870	......	......
New Westminster	958,975	1,634,518	1,124,587	......	......	......
South Vancouver	895,000	2,600,000	......	......	......	......
Lethbridge	504,954	1,385,250	1,033,380	1,211,310	1,268,215	......
Brandon	593,309	1,166,214	1,538,679	1,224,385	350,120	293,049
Total	$72,703,653	$116,886,175	$73,942,215	$49,685,338	$27,686,785	$17,810,125

These remarkable figures are significant. Are you profiting as you should by the tremendous growth of Toronto and Canada at large? MacLean Daily Reports will enable you to share in these opportunities to the fullest extent. Read the opposite page and learn how.

MacLean Daily Reports, Limited, Toronto, Ont.



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WINNIPEG : VANCOUVER

No. 106690
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March 11, 1912
PREPARING PLANS
OFFICE AND BOTTLING WORKS $30.000
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Owner, Kuntz Brewing Company, Waterloo, Ont. Architects, Mildner & Eisen, 1018 Hammond Building, Detroit, Mich.

Two storeys and basement, 104 x 90, brick, fireproof, concrete and gravel roof, sheet metal, no skylights, steam heating, sanitary plumbing, electric lighting, patent plaster, wool lath, lead and oil paint, no elevator, conveyor system to be used, reinforced concrete floors, iron beams and girders, local cut stone, cement floors, common and wire glass, figured glass in offices, some pressed brick on front, metal sash, three vaults built in, plans provide for four steel storage tanks.

Probably ready for bids in April.

TORON

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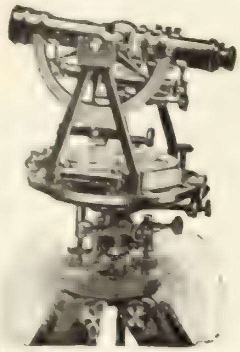

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Satisfaction guaranteed.

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1—½ yd. Smith Concrete Mixer
1—12 h.p. Portable Boiler and Engine
5 Steel Skips
15 Steam Rock Drills
4 General Service Duplex Steam Pumps
15 Vertical Boilers 4 to 25 h.p.
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50—4 yd. two way 36 in. gage Dump Cars
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24 Water Wheels—various sizes and makes

All in good condition. Full particulars and prices on application.

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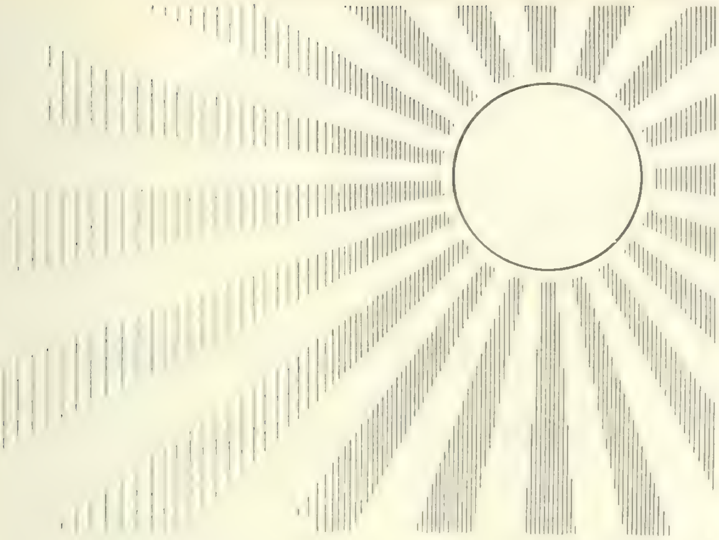

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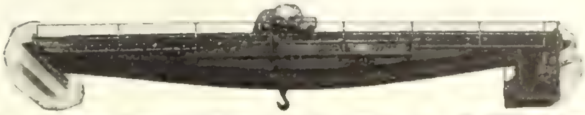

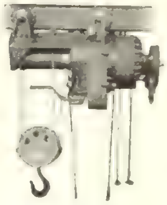

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of all designs in both iron and steel; Roofs, Telephone Poles, House Girders and all kinds of Structural Iron Work.

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Main Structural Shop: 130 ft. x 400 ft.
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Ask for list of material on hand for immediate delivery.

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We carry in stock at Montreal, 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

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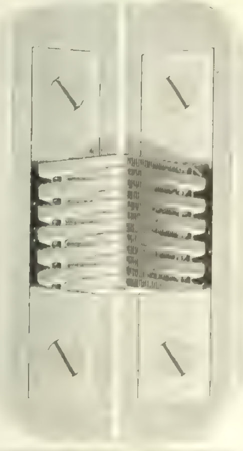

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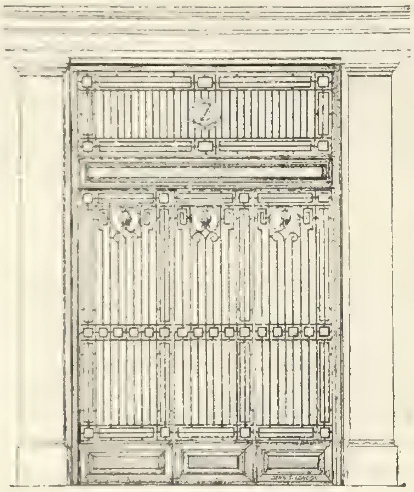

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Artistic designing and competent execution by experienced workmen makes every Dennis elevator job a handsome, competent piece of work.

Attractive, eye pleasing and thoroughly substantial examples of our ability in this line are installed in many of Canada's best structures. We would be pleased to send you a catalogue showing a number of them or if you are now figuring on this class of work let us send you designs and estimates to fit your particular job.

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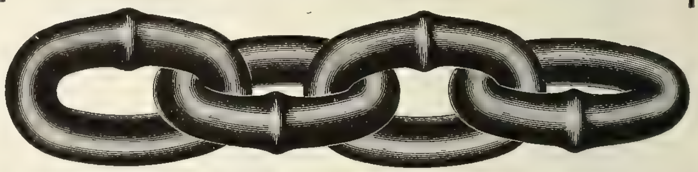

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25% More Weld = 25% More Wear

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Made by

McKinnon Chain Company

St. Catharines, Ont.

EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

Toronto Representatives: Black Building Supply Co., Mail Building
Montreal Representative: E. F. Dartnell, No. 8 Beaver Hall Square
Gorman, Clancey & Grindley, Agents, Calgary and Edmonton, Alberta

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The Ready Mixed

Hard Wall Plaster

Manufactured by

Alex. Bremner
Limited
100 Bleury Street - - MONTREAL

Engines and Boilers

of all types and sizes, Heaters, Tanks, Pumps, etc.

E. Leonard & Sons, Limited
London, Ontario

AGENTS:

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Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

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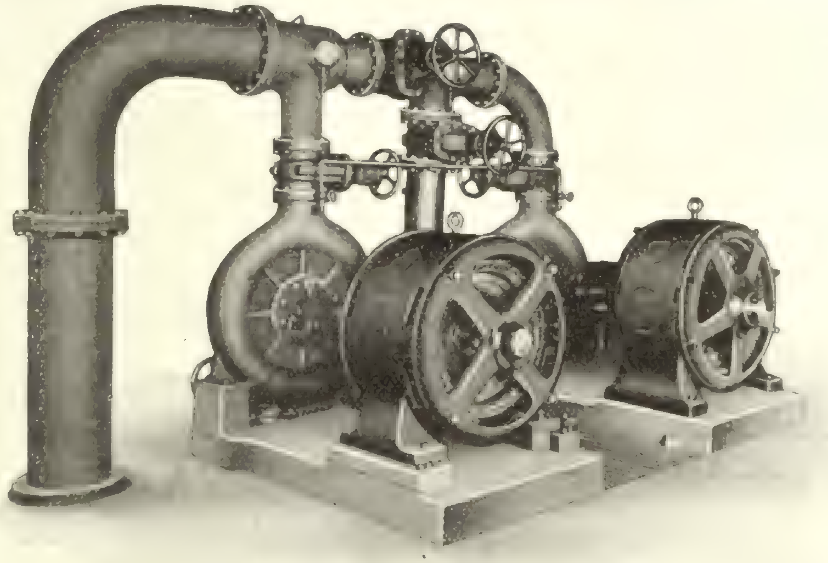
Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants

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Boarding and Commissionary Contractors

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Contractors:

We have taken the contract from St. Lawrence Bridge Company to operate their large camp on work at Quebec bridge described in Contract Record of March 18th.

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If we can successfully handle these camps does it not seem that we could handle yours?

We can save you money, and relieve you of the necessary worry connected with running your own camps. Write us for proposition.

Consolidated Boarding and Supply Co.

SAND AND LIME BRICK

THE PROCESS: Only clean, sharp silica sand, free from loam and other impurities, and high grade calcium hydrate, thoroughly mixed in exact proportions, subjected to tremendous pressure and hardened under a live steam pressure of 125 lbs. per sq. in. for ten hours.

THE RESULT: An absolutely high grade Sandlime brick; hard, even in color, uniform in size, free from breakage and growing harder and more durable with age.

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Anchor Hardwall Plaster

Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

Put up in bags ready for immediate use by mixing with water only.

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Screened Sand and Gravel

Largest Producers, Noted for Prompt Shipment.

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WE CAN SUPPLY YOU WITH EVERYTHING THAT GOES INTO YOUR BUILDING, EXCEPT THE IRON AND LUMBER

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5 Floors of This New Building, For Office and Warehouse Use.

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Special Features

Centrally located at Adelaide and Charlotte Streets.
Light on four sides
Passenger and freight elevator
Vaults
Low insurance
One block from four car lines
Floor area, 6,300 sq. feet, each floor.
Building ready for occupancy May 15th.

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— Name on request

43 Years of Service

When a fan is used forty-three years in a foundry operating at the high speeds necessary without one cent for repairs, this service is conclusive proof of the high-grade design, material and workmanship.

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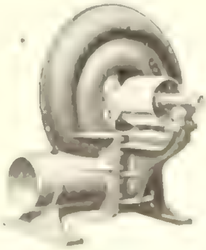
This blower will give you the same satisfactory service under similar conditions.

Ask for Bulletin 134-Z



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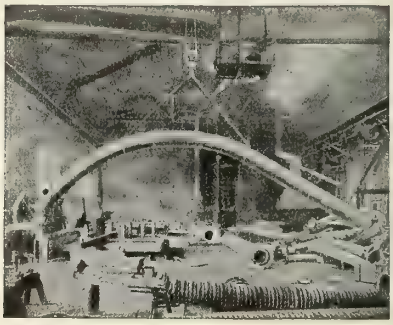

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eliminate heavy fittings
economize space,
avoid leaky joints,
save trouble, room and money

We make pipe bends in size and shape to meet your specifications. The cut above illustrates a 20 inch expansion bend of 16 foot radius containing 38 feet of pipe joined in the arc by the Atwood Line Weld.

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LIMITED

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Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
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Head Office:
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Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

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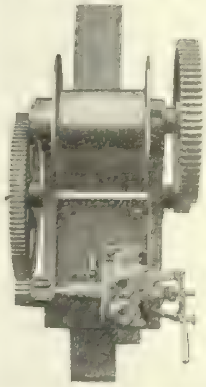

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STEAM CRANE HOISTS
MOTOR CRABS
SWINGING ENGINES

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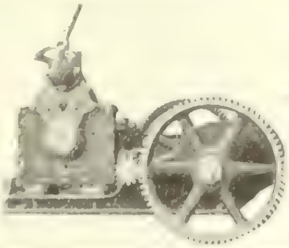

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"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

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Crushed Granilite

Graded in Several Sizes for concrete work. This is the Best material for facing Artificial Stone, Monolithic Work, Stucco, Floors, Sidewalks, Surfacing Cement Bricks, etc. Concrete made with this Material is Strong, Dense, Moisture-Repelling and looks like Natural Granite. Samples on Request.

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"Galvaduct" and "Loricated"

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for Interior Construction

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Sole Manufacturers under Canadian and U. S. Letters Patent
Toronto - Canada

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LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments
Offices, Works and Docks, TORONTO

Simplicity and Strength

These are the things that a Contractor demands of Dump Cars and the only way to get them is to buy

Bechtel Cars

Our Cars are strongly built and braced throughout and nothing to get out of order on them.

OUR LINE

Side Dump Cars	Portable Track and Switches
All-round Dump Cars	Switch Points, Frogs and Throws
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Seamless and Lapwelded

Steel Tubes

Illustration shows a Norwegian pipe line constructed of Mannesmann steel tubes, 60″ diameter, highest working pressure 640 lbs. per square inch.

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The "**Norweta**" Terra Cotta facing for above building manufactured and **set** by

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of any Size and in any Quantity on hand for Sidewalks, Roadwork or Concrete Work.

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FOR farms, railways and other drainage propositions we offer Scotia Tiles. These tiles are burned in down-draft, continuous coal-burning kilns which give them great strength and lasting qualities.

If you have a drainage problem solve it with Scotia Tiles.

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Towers and Tanks for all purposes.

Concrete Mixers

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Water supply outfits of every description.

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That's a Neat Ceiling!

Yes and it has other features besides its neatness—it is a "Metallic" Ceiling. The pattern is pleasing and artistic; the sheets are uniform in every detail; the embossing is perfect; it took very little time to lay; and the man who laid it was just a "Handyman."

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Fireproof
Sanitary
Easily Cleaned
Lifetime Lasting
Economical
Artistic

Get our prices on "Metallic" Ceilings and Walls—send dimensions. We will send you costs.

**THE METALLIC ROOFING CO.
OF CANADA LIMITED.
TORONTO AND WINNIPEG**

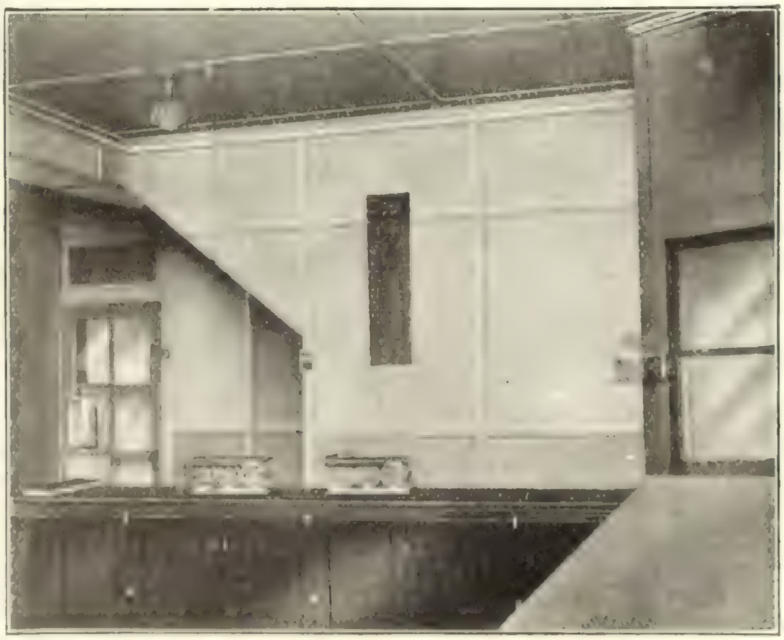
LINABESTOS
Building Board
Makes Fireproof, Sanitary Walls and Ceilings

Don't think of Linabestos as just another building board. It is something entirely different! There is no paper about it—no fibre board—no tar or asphalt compounds. It is made of Portland Cement and Asbestos, in solid, compact sheets 3/16 inch thick, 42 inches wide, and 4 or 8 feet long.

Being absolutely fireproof, Linabestos checks a blaze instead of feeding it.

Linabestos is particularly desirable for kitchens, bathrooms and finished basements, where, with a coat of paint, it gives a perfect sanitary finish—and ceilings that will never crack nor fall. It is well suited, too, for offices, halls and dining rooms, where a panelled finish is most effective.

Write for a sample of Linabestos and Folder 9 giving full information about it.



This view of a part of the Office of Wm. Rutherford & Son Co., Limited, one of Montreal's Leading Lumber Dealers, shows an attractive and absolutely fireproof Linabestos finish. Rutherfords are so well satisfied that they are now selling LINABESTOS.

ASBESTOS MANUFACTURING CO., Limited

Address: E. T. Bank Bldg., 263 St. James St., Montreal Factory at Lachine, P.Q. (near Montreal)

IRON AGE

Steel Tray Barrow

SPECIALLY suited to the needs of contractors and workers on concrete. This barrow has a tray pressed from solid sheets of high carbon steel, without seams or joints. It can save much time and money on any concrete job.

Send for our catalogue.

THE BATEMAN-WILKINSON CO., LIMITED
340 CAMPBELL AVE., TORONTO

BUILDERS' SUPPLIES

Lime	Fire Brick
Portland Cement	Sewer Pipe
White Cement	Weeping Tile
Keenes Cement	Sacketts Plaster Board
Plaster Paris	Parkers Corner Bead
Hard Wall Plaster	Rubble Stone
Mortar Colors	Crushed Stone, Etc.

With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

Ontario Lime Company
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Head Office Phones: Main 5472—5473

"EBANO" and "EAGLE" Brands

MEXICAN ASPHALT

HERKIMER ST., HAMILTON. Paved with our Mexican Asphalt.

Write for analysis and samples

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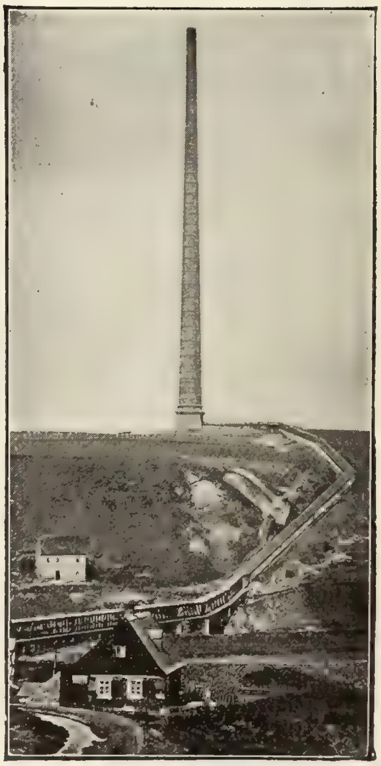
Sole Canadian Agents for the Mexican Eagle Oil Co.
Also Agents for MASTIC ASPHALT for Sidewalks.
428 Transportation Bldg., MONTREAL



460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a **HEINICKE.**

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Representatives for Canada:
Black Building Supply Co., Ltd., Toronto
Dartnell Ltd., Montreal, Que.

Sand, Gravel and Crushed Stone

Lime
Cement
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Sewer Pipe
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Building Stone

Our prices are right and our service good.

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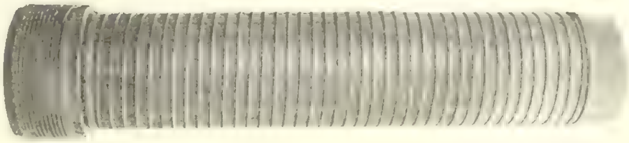
VANCOUVER WOOD PIPE & TANK CO., LTD.
(Formerly Municipal Construction Co., Ltd.)



Contractors for Waterworks Construction,
Manufacturers of Wire-Wound Wood Pipe, Continuous Stave Pipe, Tanks, Silos, Steam Casing.
See our new patented Wood Pipe Coupling—Positively LEAK PROOF.

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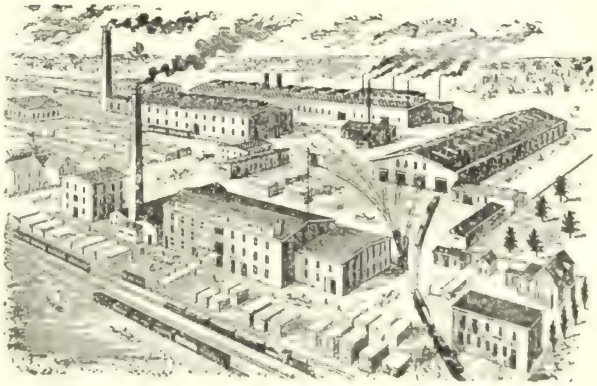

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We manufacture all kinds of building materials, including cast iron columns, cresting, sash weights, etc.

In addition to our large stock of native lumber, we are now carrying about one million feet of foreign lumber, including oak, walnut, ebony, whitewood, basswood, red cedar, Douglas fir, mahogany, &c.

Rhodes, Curry Co., Ltd. Amherst, N. S.

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Halifax, Sydney and New Glasgow.

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Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

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Montreal TORONTO Winnipeg

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Portland Cement, Lafarge Cement, Gravel, Sand, Rubble, Imported and Canadian Pressed Brick for front work and fireplaces.
CRUSHED STONE - Dimension and Coursing Stone, Lime
FIRE BRICK **IVORY CEMENT PLASTER**

—Yards—
75 Brock Ave., Jarvis Street Wharf,
Avenue Rd. & C. P. R., 355 Eastern Ave.

The Contractors' Supply Co., Limited
182 Van Horne St., Toronto Tel. M. 6859

Current Prices of Building and Engineering Materials

CEMENT, LIME, AND BRICK

Toronto prices (wholesale) delivered:

Cement—delivered in 5 barrel lots, $1.85 per bbl.; car lots, $1.55. Pkgs extra.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the [illegible], white 37c, grey 35c.

Brick—No. 1 dry pressed red and buff brick, $18; common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick (a) $8.10, King Edward siding, (b) $10.50 delivered on the job. paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18. Brick 2½ x 4 x 8½ in., blocks 3½ x 4 x 8½ in.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.10, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

The Corbett Contracting Company, Limited, has been incorporated to carry on the business of general and railway contractors, engineers and builders; to manufacture, buy and sell lumber and pulp, etc. The town of Welland, Ont., will be the headquarters of the company, which is starting out with a capital stock of $100,000.

The Siemens Company of Canada has received an order from the Canadian Ingersoll Rand Company for two 380 h.p., 3-phase, 2,200 volt, 60 cycle, 146 r.p.m. induction motors of the slip ring type, provided with short-circuiting and brush-lifting device, together with two Siemens' liquid starters and cast iron mining pillars for the Acadia Coal Co., Nova Scotia. These motors are to be used for driving air compressors.

The Universal Tool Steel Company, Limited, is the name of a new company which has been incorporated to carry on business as iron masters, steel makers, steel converters, engineers, tin plate manufacturers, etc. There is a capital stock of $10,000,000 and the head office will be at Toronto.

Vickers, Limited, the big English company, which opened workshops and plants in Montreal during 1913, realized the largest profits in its history, amounting to £911,996. The dividend rate has been increased from 10 per cent. to 12½ per cent.

Mr. J. J. Fingland, of Kaslo, B.C., who a few weeks ago was appointed as sistant assayer in connection with the experiments in electric smelting of lead-zinc ores at Nelson, B.C., has been appointed by the Provincial Government road superintendent for the Kaslo riding.

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Architects
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Architects and Building Surveyors
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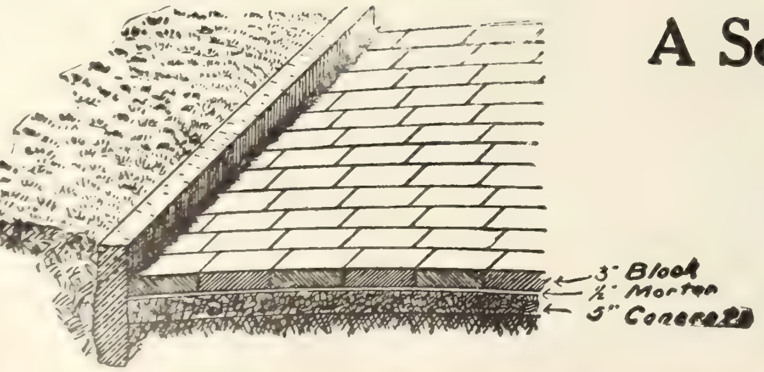

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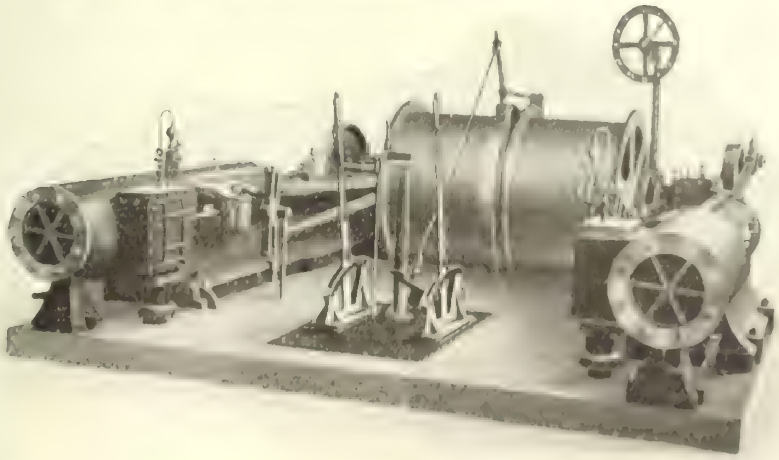

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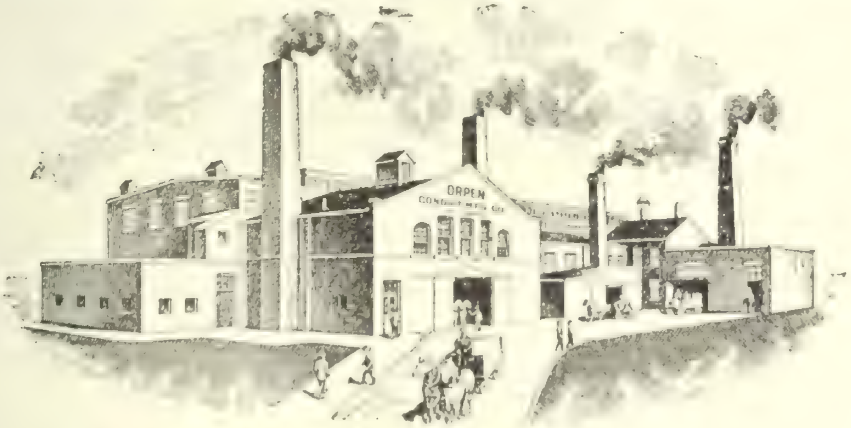
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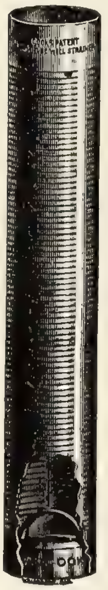

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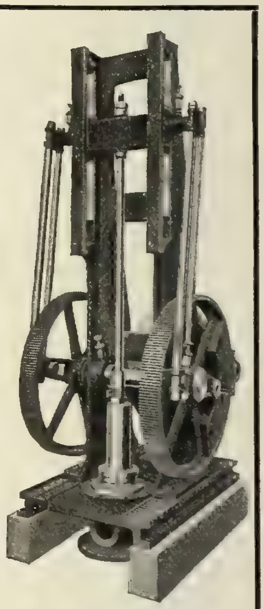

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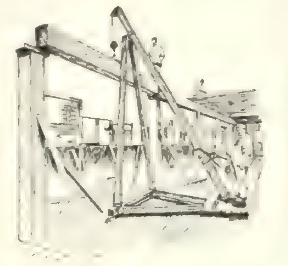

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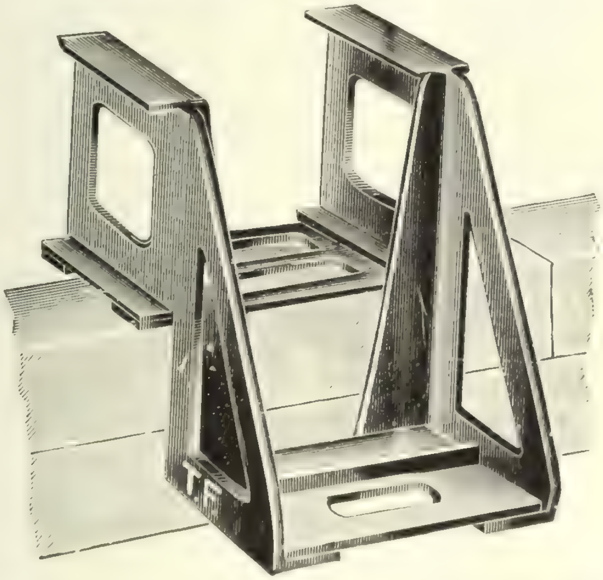

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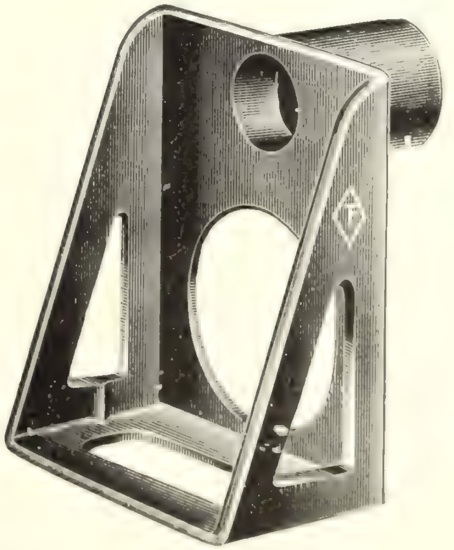

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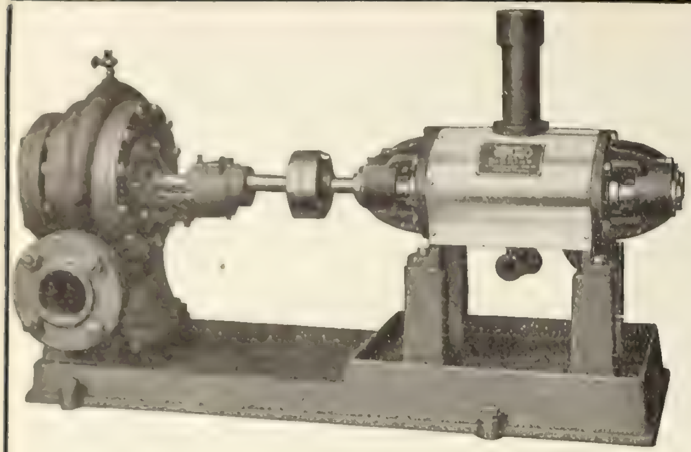

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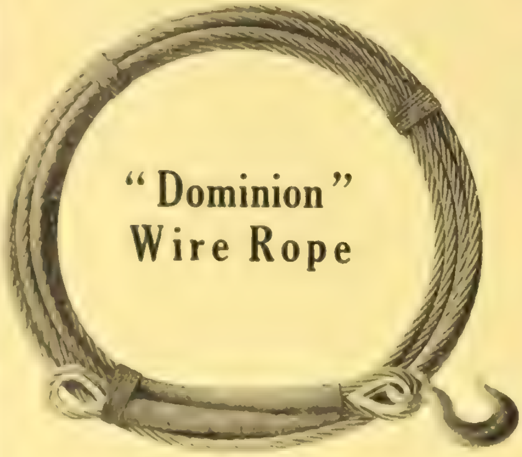

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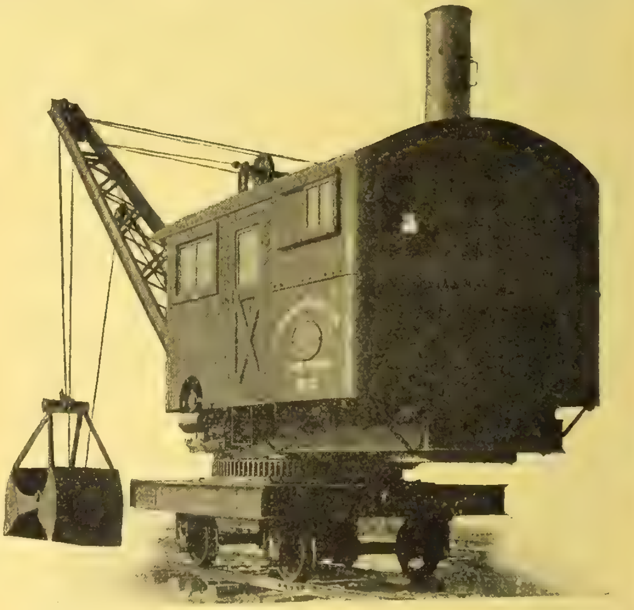

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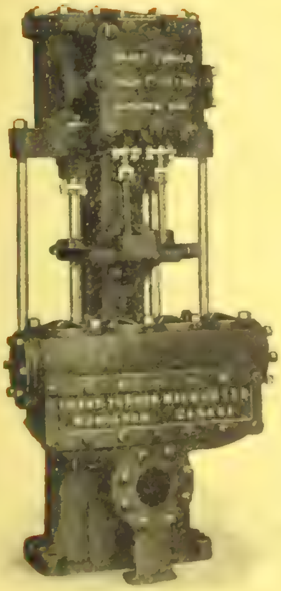

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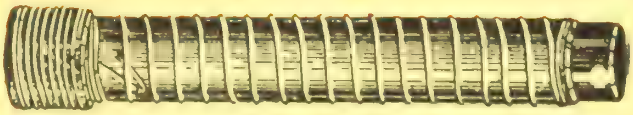

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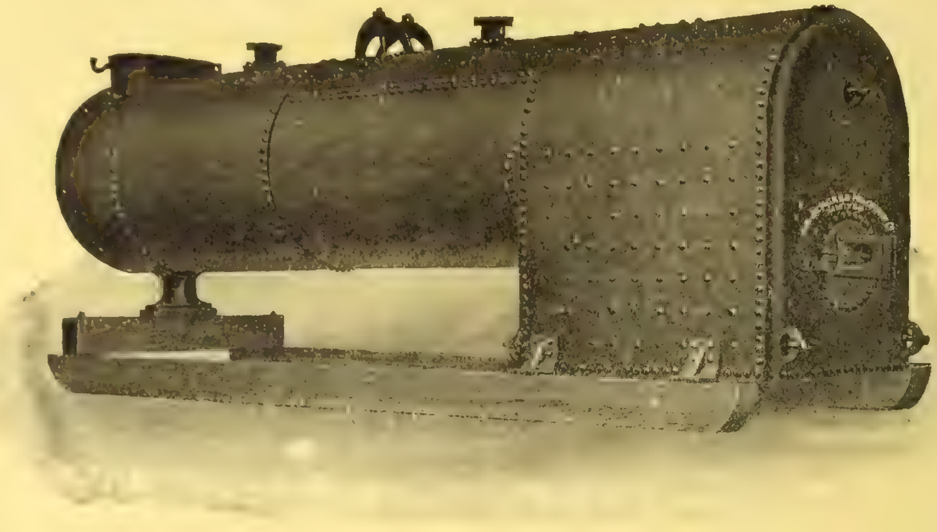

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Sheaves In Hard-to-get-at Places Should be Equipped with

"American" Self Lubricating Bushings

THESE bushings are cast from a carefully balanced combination of metals, which years of experience and experiment have taught us is best suited for the purpose. They are filled with a special lubricating compound which lasts as long as the bushing itself and keeps the sheave running smoothly and easily without the slightest attention.

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American Hoist & Derrick Co.

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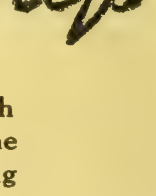
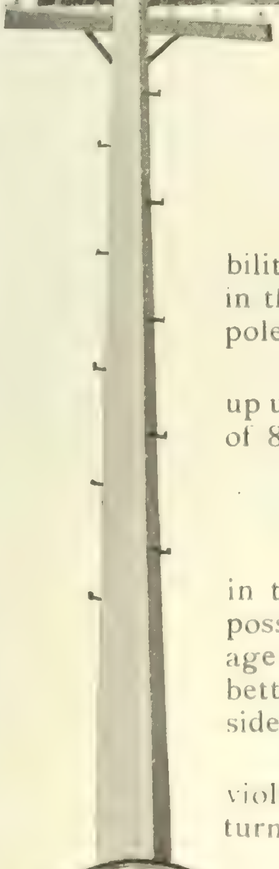


Concrete poles along the Pennsylvania Railroad across the Hackensack, Meadows New Jersey.



Concrete Poles Withstand Terrific February Blizzard

One of the most striking examples of the durability and stability of poles carrying telegraph and service wires, is that contained in the performance of the Pennsylvania Railroad's line of concrete poles across the Hackensack Meadows during the February blizzard.

These poles are badly exposed from all sides, but they stood up under a great weight of snow and ice and resisted a wind velocity of 80 miles an hour.

Municipalities and corporations wishing to

Minimize "Service Breaks"

in telegraph, telephone and service lines should investigate the possibilities of concrete poles. They not only gain strength with age but they do not rot or rust. No other type of pole will keep better alignment. They are not prohibitive in first cost and, considered as a long time investment, are exceedingly economical.

The cost of "broken service" and the repairs necessary after one violent storm would equip an entire line with Concrete poles which, in turn, would serve to prevent a great many future "breaks in service."

Full information about Concrete poles will be sent free to those interested, upon request to

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Is Making Big Profits—
WHY NOT YOU?
Put a *SMITH MIXER* on
the job and cease worrying.

They work the quickest, last the longest and have the lowest operating expenses. Built for steam, electric, gasoline or belt drive.

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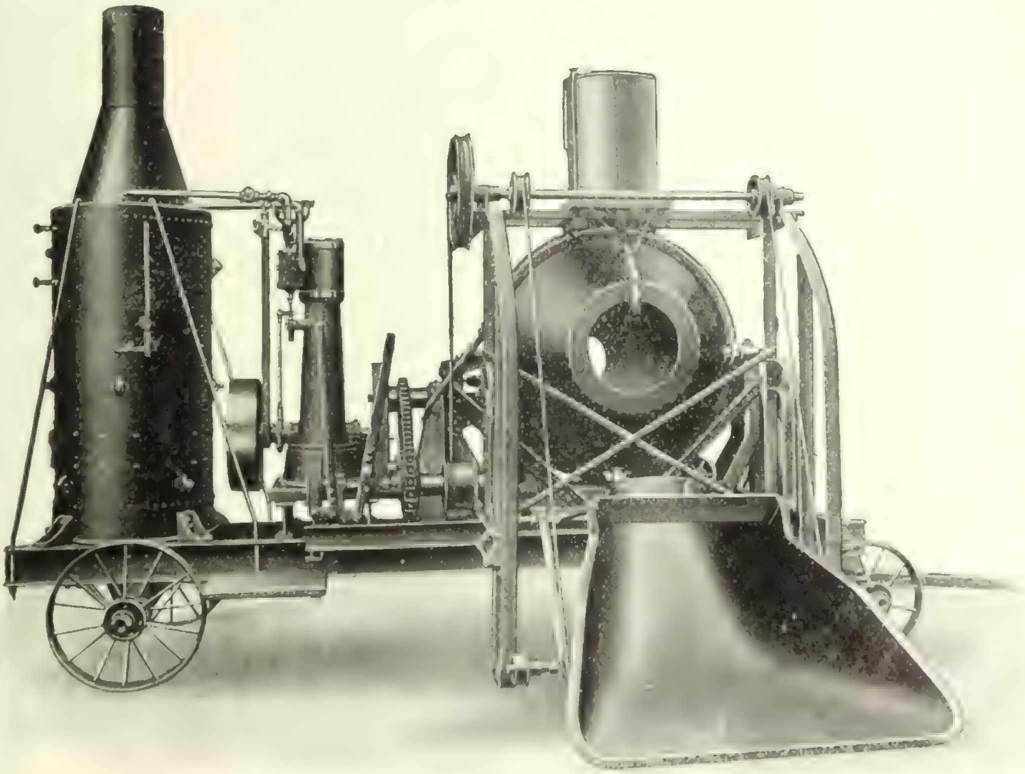
It Means Dollars and Cents

To You to Have Reliable Equipment on the Job.

Smith Concrete Mixers



BUILT RIGHT WORK RIGHT

The most satisfactory mixer on the market.

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This hose can be used to advantage wherever air or steam hose is now employed. Excavating and tunnelling contractors, mining companies and quarrymen will find it far more efficient and economical in operating drills and other machinery than any hose heretofore used. Machinists using either air driven or steam driven tools will find it much more reliable and durable than ordinary unarmoured or wire-wound hose.

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SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
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Engineers and Contractors

Buildings and Construction Work

OF ALL KINDS

Reinforced Concrete a Specialty

Write us for preliminary plans, estimates and photos of our work.

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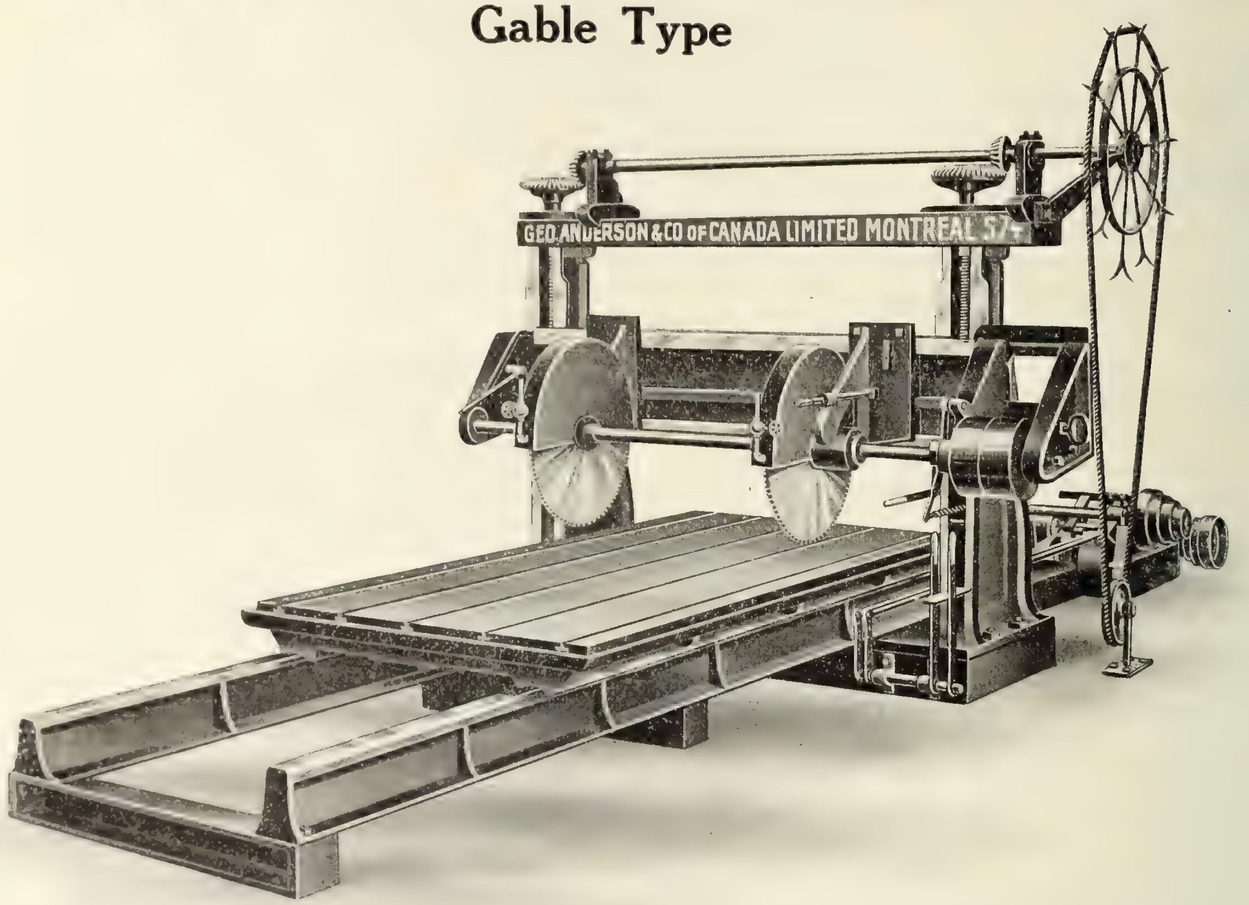
Duplex Diamond Saw

Gable Type



The cutting capacity of this machine, fully loaded, with fast feed speed is 160 superficial feet per hour.

This machine is specially suitable for ***Monumental Stones, Tiles, Details.***

We Also Manufacture

Cranes and Derricks

Geo. Anderson & Co. of Canada, Limited

Montreal, Que. and Carnoustie, Scotland

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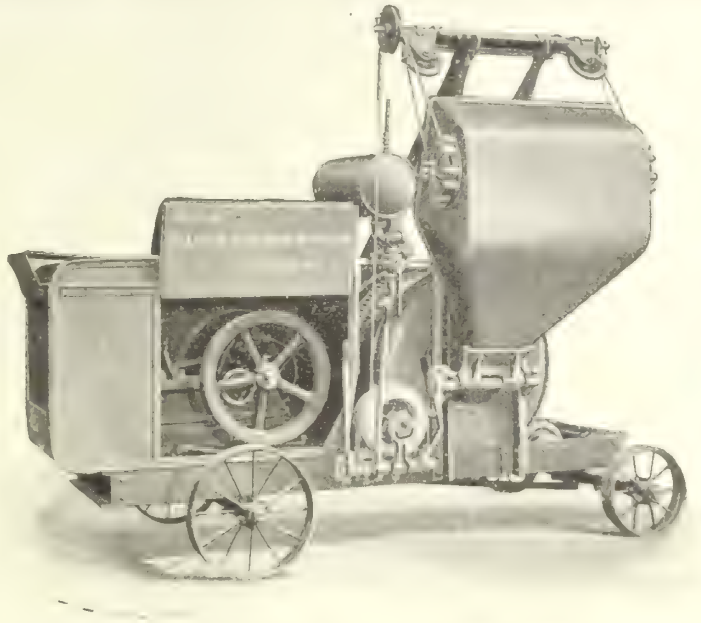
Most Mixing



Least Fixing

It is with much satisfaction that we announce to the contractors and builders of Canada our recent connection with the Marsh-Capron Mfg. Co., of Chicago. Knowing full well the heavy demands placed upon a concrete mixer in Canada we spared no effort to determine which, in our estimation, was the best mixer built. As a result of this investigation we are proud to offer

THE M-C RAIL TRACK MIXER

Equipped with Fairbanks-Morse Gasoline Engines

There are several hundred of these mixers in successful operation in Canada—there were five used on the big C. P. R. irrigation job at Bassano, Alberta. We carry a complete stock of all sizes and equipment at our several warehouses and are always in a position to make immediate shipments quick.

Write our nearest branch

CANADIAN FAIRBANKS-MORSE CO., Limited

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Manufactured by

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High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engines built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

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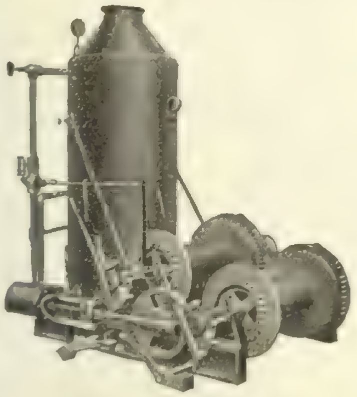

Standard Hoisting Engine

The London Concrete Machinery Co., Limited

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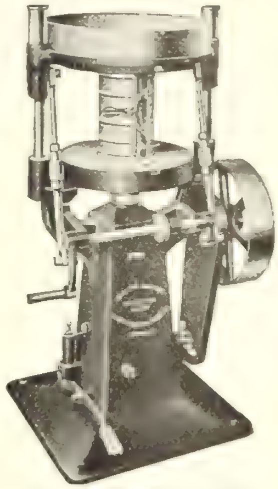
the Largest Manufacturers of Concrete Machinery in Canada



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Concrete Mixers

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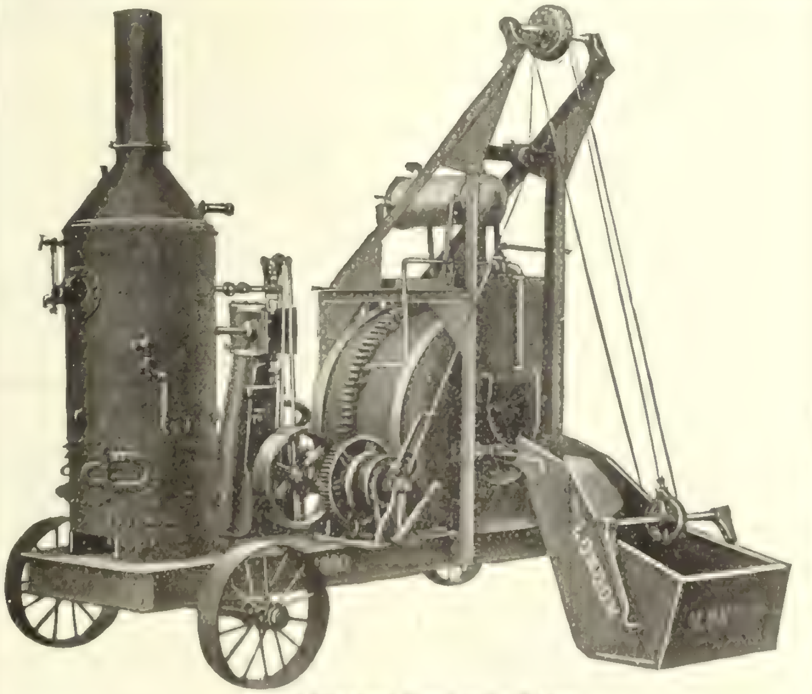

London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

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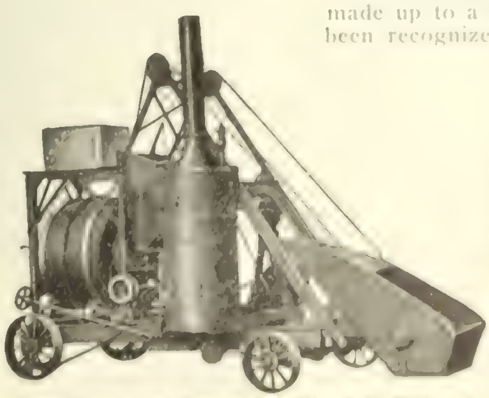
We also manufacture a full line of hoisting, quarry and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader

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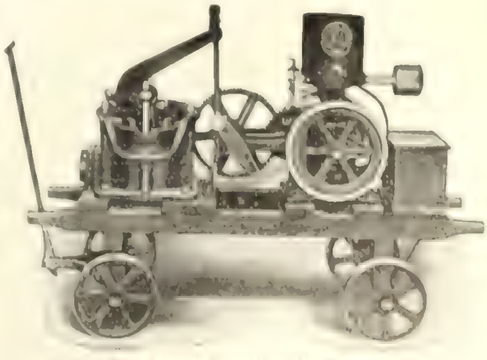

Diaphragm Pump with Power

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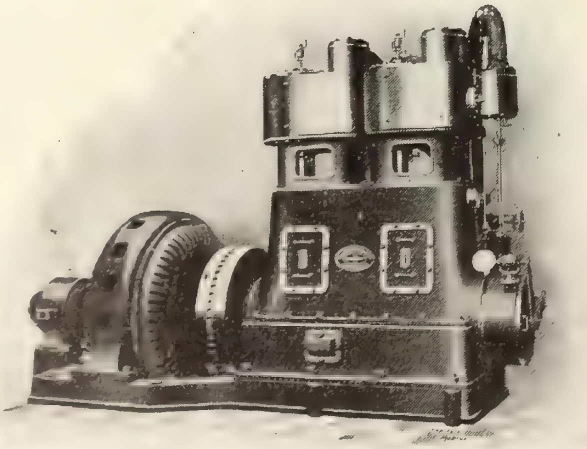
BRUCE PEEBLES



Peebles-Browett Alternator Set

Alternators and Generators

are built suitable for belt-drive or for direct coupling to any form of prime mover.

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90 Sherbourne St., TORONTO

Farmers' Advocate Building,
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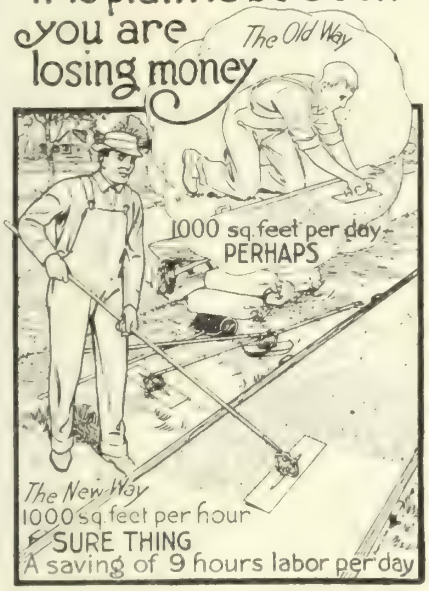
If you are not using

"ABRAM" TOOLS

It is plain to be seen you are losing money



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Windsor, Ontario

1877

37 Years of Rapid Progress

THE Western Wheeled Scraper Company was inaugurated in 1877. With wheeled scrapers as the first manufacture, the line has been increased from time to time, until now it comprises almost every kind of earth and stone handling machinery.

The constant aim of this company has been to produce the best possible goods in this particular line of manufacture, and the increasing demand for Western products is ample proof of their superiority.

Write us today for catalog

WESTERN WHEELED SCRAPER CO.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta.
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1914

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
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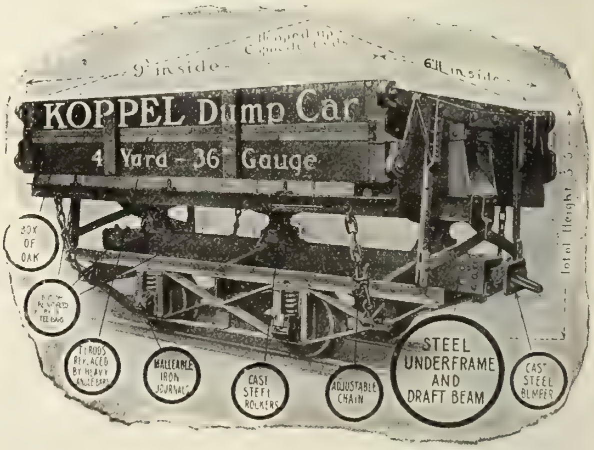

What Big Contractors

Say About This Koppel Car

Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

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See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

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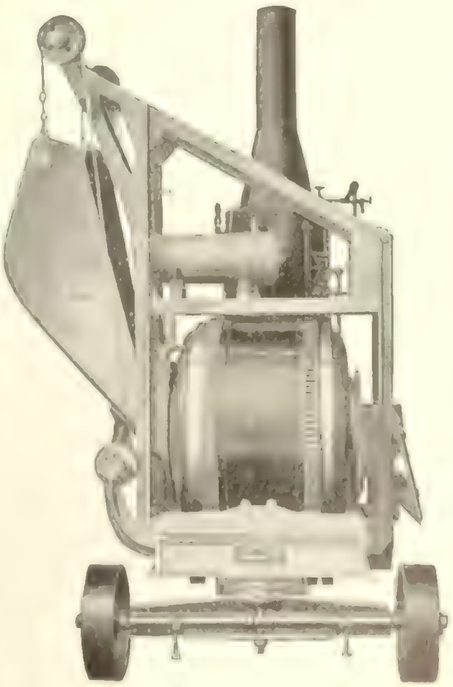

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Type O Thew Shovel on Road Grading

“We are very sorry we did not buy the shovel long ago.”

That’s what the owner of this Type O Thew Shovel said after he had put the Shovel to work and saw the amount of money he might have saved had he only realized sooner that **The Thew Shovel really does handle shallow as well as deep cuts efficiently and economically.**

Here’s what the contractor owning this shovel wrote us:—

“The Shovel loaded 1,965 cu. yds. in seven days in a one to four foot cut, part of which was solid limestone. There is no mistake about the shovel being a time saver and a money maker and now that we know what the shovel is, we would not be without it and are very sorry we did not buy the shovel long ago.”

Before you decide how you are going to handle your excavating let us refer you to some contractor near you who has used a **Thew** on the same class of **Work.**

There are over **1,000 Thews** in service. Some of them are near you. Investigate the results being secured with the nearest Thew and be convinced.

WRITE FOR CATALOGUE AND LEARN
WHY THE THEW IS BEST

The Thew Automatic Shovel Company, - Lorain, Ohio

Back view—Plant No. 3, New Glasgow, N.S.

Front view—Plant No. 3, New Glasgow, N.S.

Sewer and Culvert Pipes

HOLLOW BUILDING BLOCKS

The "Standard" clay products includes an excellent fireproof building. If you are contemplating fireproof construction we will be glad to hear from you to quote you prices and submit samples.

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES: **St. Johns, P. Q., and New Glasgow, N. S.**
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VITRIFIED AND SALT-GLAZED

Quality

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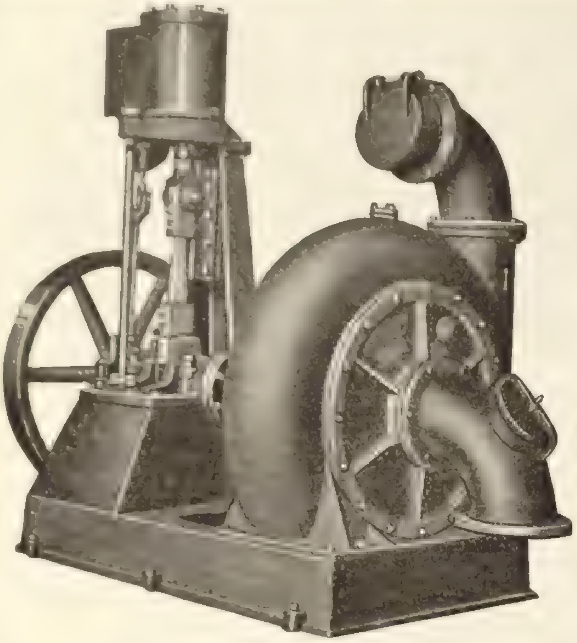
ROUND PIPE AND SQUARE DEALINGS

The Ontario Sewer Pipe Company, Limited
MIMICO, - ONT.



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MORRIS MACHINE WORKS - Baldwinsville, N.Y.
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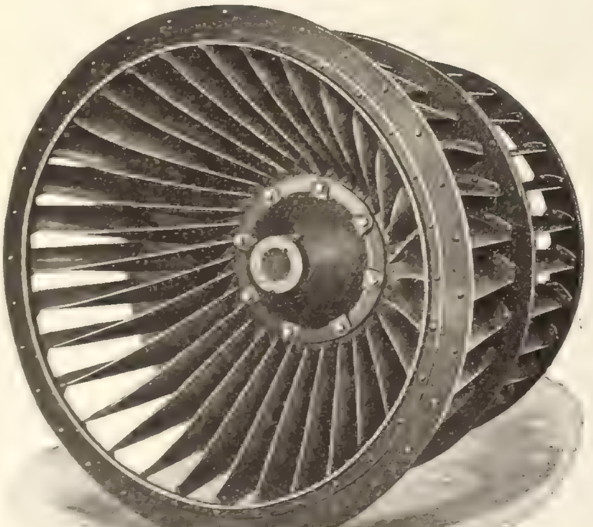

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A great advantage will be gained to consult us when considering the installation of a Heating and Ventilating System.

Our ***"Keith Fan"*** has come to the front in the Heating and Ventilating World and is considered by experts to be the most practical and economical Fan yet produced.

It will pay you to investigate ***"Keith Fans."***

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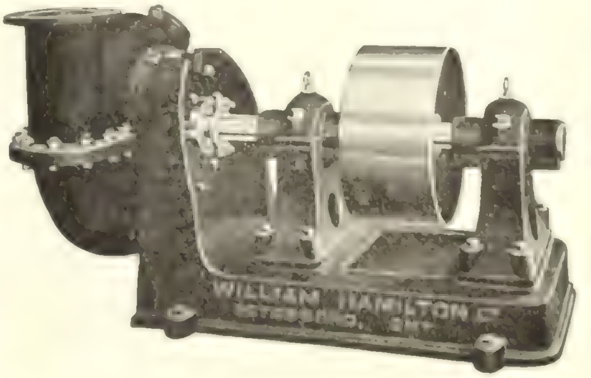

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These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

William Hamilton Company
Peterborough, Ontario

J.O.B. CONTRACTORS PUMPS

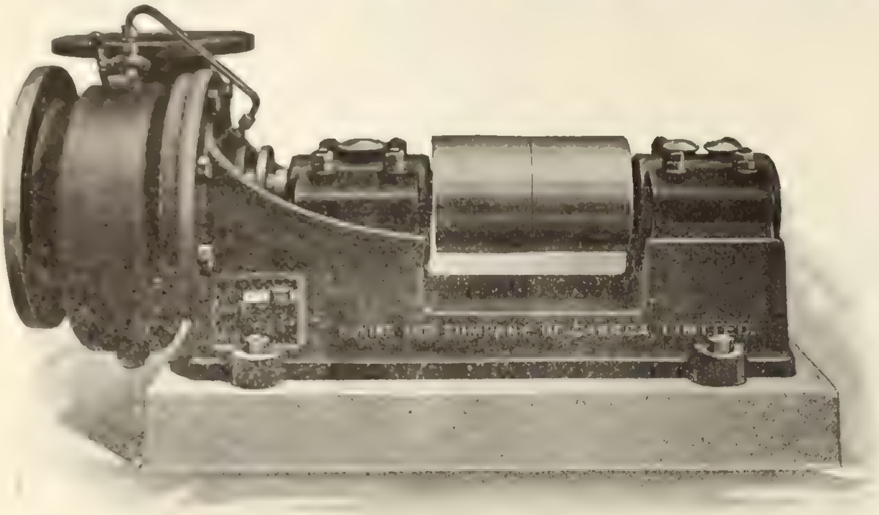

Illustration shows 10″ Contractors Pump.

Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

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Pumps for all purposes
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High, Medium and
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"A Mix a Minute"

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Big-an-Little Mixer

That is the record we have hung for speed—"A Mix a Minute" and it is the speed standard that every "Big-an-Little" mixer is living up to.

The drum is conical-shaped and revolved by power from a gasoline engine which is housed on the mixer frame.

For speedy and thorough mixing the "Big-an-Little" mixer is the strongest, lightest and most economical machine on the market.

Why mix concrete otherwise *now* that you can obtain the Big-an-Little.

We want Canadian agents
Write for our catalogue, etc.

Jaeger Machine Co., Columbus, Ohio

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CAN BE OBTAINED BY USING

Apollo Keystone Copper Bearing Galvanized Sheets

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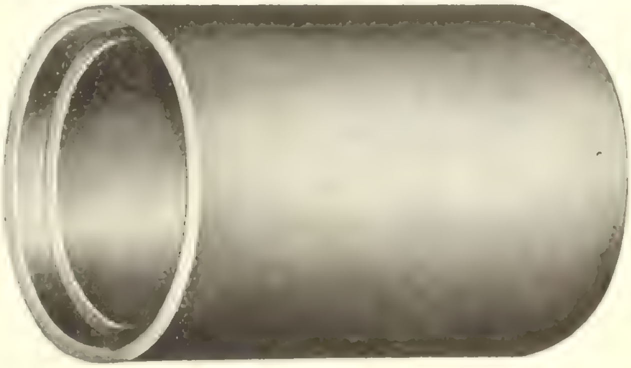


OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

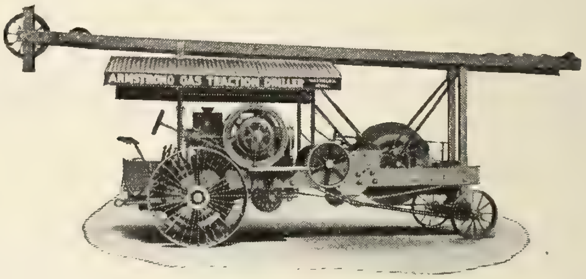
Dominion Concrete Company Ltd.

Kemptville, Ontario

DANGER!

There are "BREAKERS AHEAD" for the Quarry Operator Who Does Not

STOP! and consider—that the most economical method of drilling blast holes is with an Armstrong Special Blast Hole Drill—that the same efficiency should be demanded from the drilling machines as from any ot the quarry equipment—that the method of drilling employed frequently represents the division between profit and loss—that in adopting this system of drilling, the labor problem is reduced to a **minimum** and that the **"Armstrong" is the only special blast hole drill designed for rock drilling exclusively.**

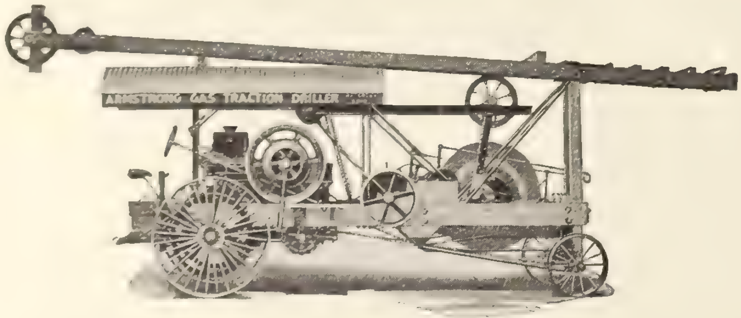


Armstrong Water Well Drill

LOOK! at these two machines illustrated on this page. One is a Well Drill, the other a Special Blast Hole Drill. Little difference in the general design with the exception of the Spudding Beam; but note this difference carefully. That one feature determines the results you can expect from your tools in a drilling motion—is the one point that increases your efficiency from 50% to 100%, and is the reason why the **Armstrong Special Blast Hole Drill** will drill more blast holes, at less cost, and with less wear and tear than any other machine made.

LISTEN! to reasons:—We illustrate our Water Well and Blast Hole Drills so **you** can see the difference—so that **you** will know that the drill we call our Special Blast Hole Drill is not a Water Well Drill, and so that you may "ask to be shown" by any manufacturer of cable drills the difference in the design of their blast hole and water well drilling equipment.

Armstrong Special Blast Hole Drill



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Homestead Avenue, Mt. Vernon, N. Y.—Aztec Road Binder Penetration Method

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For Every Road

For macadam, dirt and gravel roads, Aztec Liquid Asphalt provides the best and most efficient surface treatment. It is a pure, natural maltha possessing the necessary constituents to cause it to penetrate thoroughly the surface of a roadway. Upon evaporation there is left a hard asphaltic binder, which gives the road the appearance of a sheet asphalt pavement.

The great demand for Aztec Liquid Asphalt last season is the result of the experience and recommendation of those who have previously used it.

Aztec Asphalt for city pavements is the best known material for this purpose.

COMMERCIAL USES

Astec is supplied with the consistency best suited to the special purpose for which it is required. Prompt deliveries on asphalt for

ROOFING
WATERPROOFING
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For sheet asphalt or for road binder—either mixed or penetration method—Aztec excels.

We also sell Aztec Fuel Oil and Gas Oil.

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Aztec Oil & Asphalt Refining Co., of Canada

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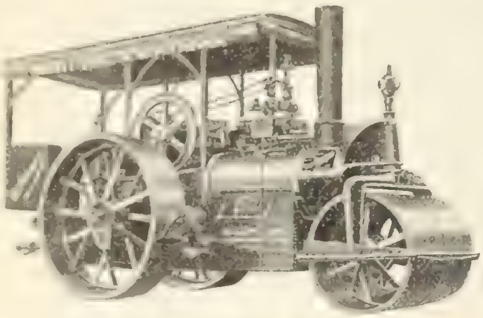
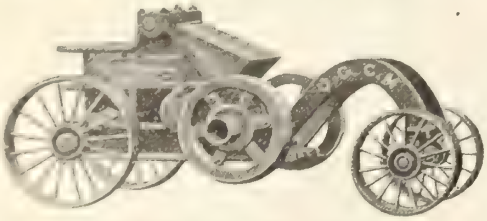


"Montmagny" Steam Road Roller.

"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny"
Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"

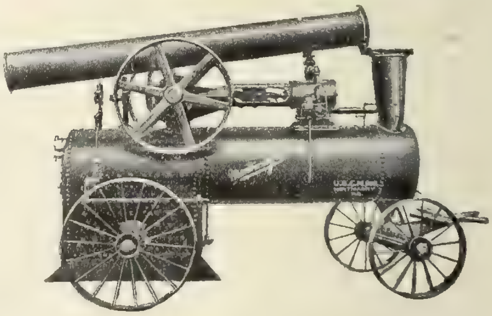
The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

For crushing field stone, granite, etc., "Montmagny" jaws are made of **manganese steel.** They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.

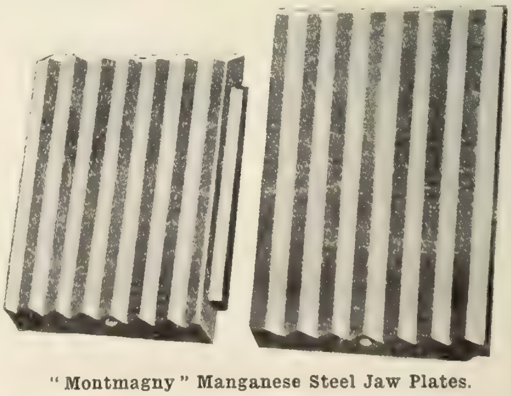
"Montmagny" Road Sprinkler.

The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.



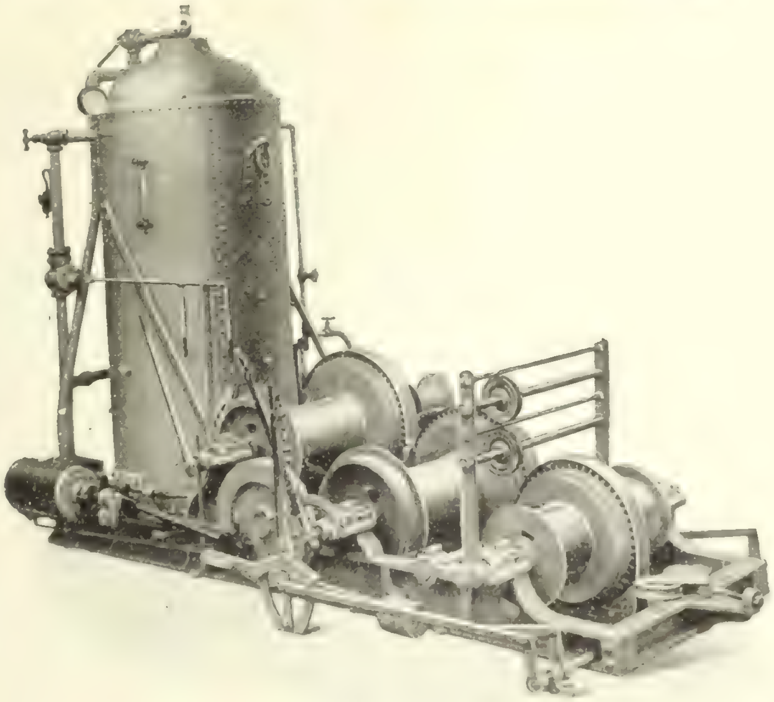
"Montmagny" Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.



"Montmagny" Manganese Steel Jaw Plates.

BEATTY HOISTS and Material Handling Plant



STANDARD DOUBLE CYLINDER, DOUBLE FRICTION DRUM HOIST WITH NO. 2 SWINGER.

The satisfactory performance of Beatty Hoists and Clamshells has been demonstrated on thousands of jobs throughout the Dominion.

If you require a Single, Double or Triple Drum Hoist of any size, let us show you what we can do in the way of construction, delivery and price.

We can meet your requirements on all three counts.

Standard size Hoists, Clamshells, Derrick Irons, etc. ready for immediate shipment.

Let us send you our new general catalog.

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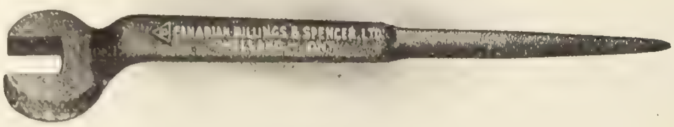

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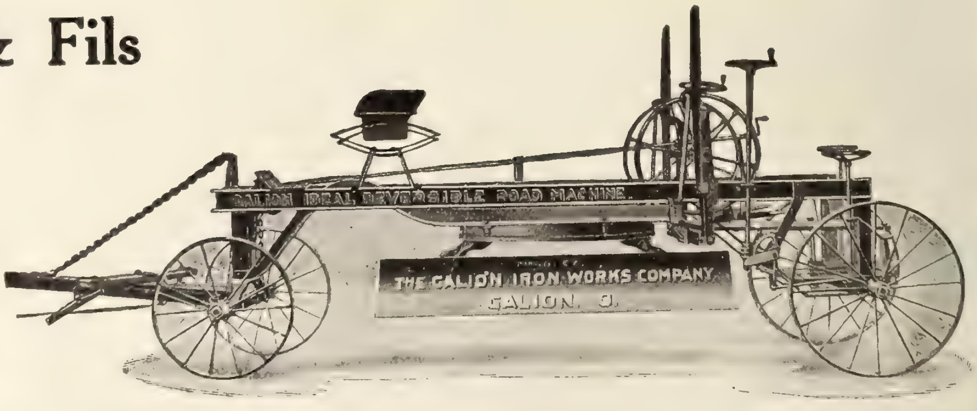
Road Graders, Rock Crushers, Portable Engines, Steam Road Rollers, Sprinklers etc.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THE GALION IRON WORKS COMPANY
GALION, O.

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That concrete is everlasting and hardens with age is a fact—proven in the laboratory and in practise—the pyramids in Egypt are of concrete. Does it not follow that

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made of concrete under a pressure of half a million pounds and then steam cured, should last as well as the pyramids? Some of Canada's finest buildings contain Enamel Concrete Brick. You should know about it—write us.

The National Builders Supply & Enamel Concrete Brick Company, Limited
MONTREAL

Rust Through Paint

The common fallacy of placing too much dependence on protective coating is proved by the experiments described in the following article published in a recent issue of the "Contract Record"—

> From experiments made by Dr. E. Liebreich and Dr. F. Spitzer, as reported in Die Umschau, it appears, says the Times, that the general opinion that rust in iron is prevented by a cover of paint is not always correct, and that in fact the paint itself may be the cause of rust. During the experiments made it was found that polished steel bars, which had been given one coat of paint, and upon which distinguishing numbers were painted, rusted principally, and in some cases solely, in the place where they might have been considered doubly protected—namely, under the thicker layer of paint at the numbers. Five colours were then selected, and some iron plates were given one coat and some four coats of paint, each coat being perfectly dry before the other was applied. These were exposed during 24 hours to a jet of steam. The places with one coat remained intact, the others were completely rusted. It is surmised that this result is due to the fact that the varnish of the second coat dissolved the paint of the lower one and thus made it porous, and that the porosity increased with the number of coats applied.—**Contract Record & Engineering Review.**

Moral: CONSIDER THE BASE METAL

For Dependable Durability, Specify:

A Few Uses:

- Roofing
- Siding
- Cornices
- Skylights
- Tunnel Lining
- Refrigerators
- Conductor Pipe
- Eaves Trough
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Corrosion-Resisting Black and Galvanized Sheets.

Write for "TEXT BOOK ON CORROSION."

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Oshawa - Montreal - Toronto
CANADIAN DISTRIBUTORS

The Stark Rolling Mill Co.
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Don't Just Line Walls with Sheathing Paper— Insulate Them

The insulating effect of ordinary sheathing papers is practically nil, because, being thin and porous, they confine practically no dead air.

Keystone, because of its cushion-like construction, contains millions of "dead air" cells to the square foot, which makes it the most efficient insulating material on the market.

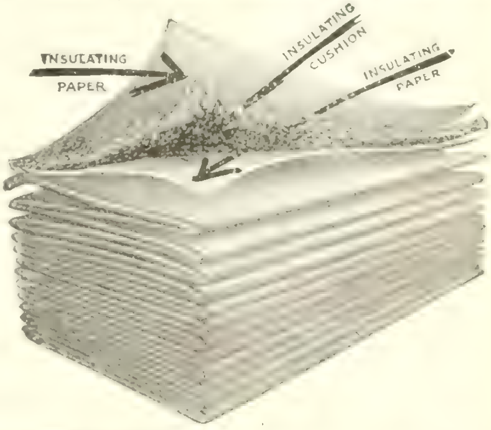
Keystone Hair Insulator

is made of a thick layer of thoroughly cleansed and sterilized cattle hair, securely fastened between two sheets of strong, non-porous insulating paper.

We have proof in the form of actual tests and testimonial letters that it has reduced fuel bills from 25 to 35 per cent

Keystone will not settle, pack down, dry out, rot or attract moisture. It is inodorous, vermin-proof, and will last as long as the building. Is an effective fire retardent.

Write our nearest Branch for Catalog and Samples



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The Canadian
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Manufacturers of Asbestos Roofings; Pipe Coverings; Conduit; Metallic Hose; Waterproofing; Mastic Flooring; Stack Lining; Packings; Boiler Preservation, Etc.
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Lime-Sand
Clay, Slag,
Clinker,
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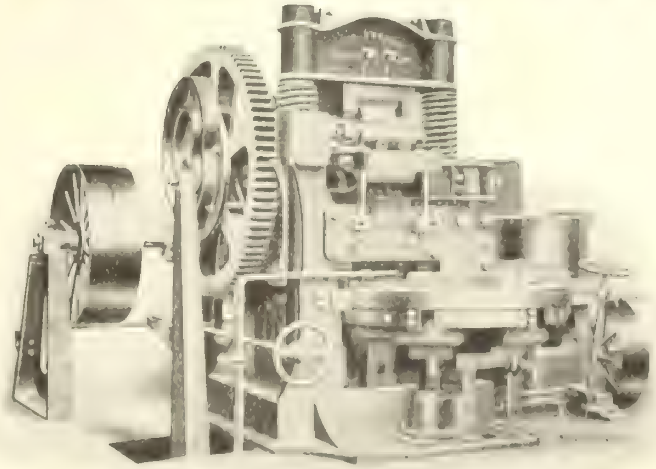

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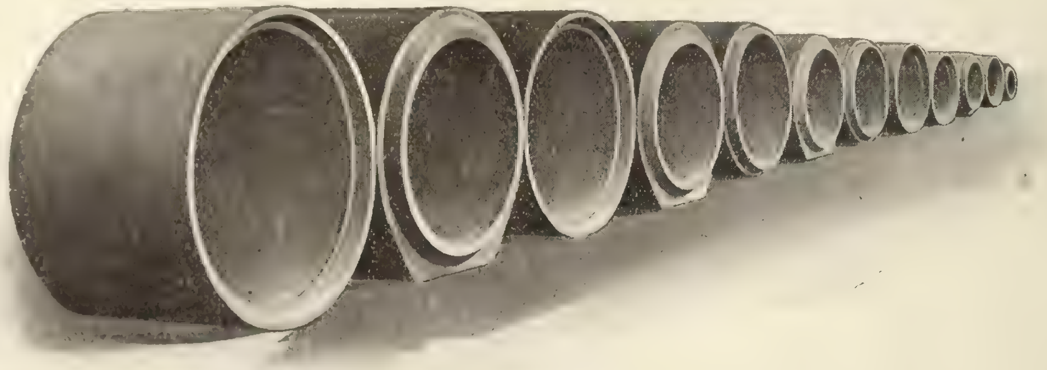
We make a point of supplying special ornamental trimmings for public buildings, churches and schools.

Your enquiries are respectfully solicited, and will receive prompt attention.



National Concrete Mfg. Company, Limited
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A Successful Architect Can Make One Dollar Spent In Construction Do The Work For Which Another Will Need Two Dollars

All baggy places in metal lath have to be filled out with plaster.

Herringbone Metal Lath, (The Ribbed Kind) does not bag.

All plaster that drops between the studs is wasted.

Herringbone Metal Lath, (The Ribbed Kind) does not drop plaster between the studs. The ribs act as shelves and hold the clinch in place.

Diamond mesh lath is only satisfactory on twelve-inch spans.

Herringbone Metal Lath, (The Ribbed Kind) spans sixteen inches. Leave out all cross-furring. Place it directly on the joists and save nine cents per yard.

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The Metal Shingle & Siding Company, Manufacturers

Cincinnati General Hospital
Specified here

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BRICK AND CEMENT COATING

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They preferred our coating to others because it not only protects against moisture but "lights like the sun" and does not flake off when properly applied and is **absolutely sanitary.**

Let us send you Booklet 10 that explains many ways of waterproofing and decorating both exteriors and interiors.

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BRITISH POLISHED PLATE IN ALL SIZES

All descriptions of Window Glass may be obtained from our warehouses named below.

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PRISMATIC—Ornamental, figured, rolled, etc.
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SPECIAL—We strongly recommend a trial of our 3rds quality window glass.

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WORKS: ST. HELEN'S, LANCASHIRE, ENGLAND—THOROLD, ONTARIO, CANADA
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Announce the opening of their new plant, equipped with the most modern and up-to-date machinery for the manufacture of—

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(Annealed and Unannealed)

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OUR SPECIALTY

- Tube Mill Feeders
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Patterns for all these lines kept on hand.

Machine Moulded Gears up to 16 feet. Castings.

We solicit your patronage and prompt attention will be given to tenders on above work.

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The Up-to-Date Contractor is today using a

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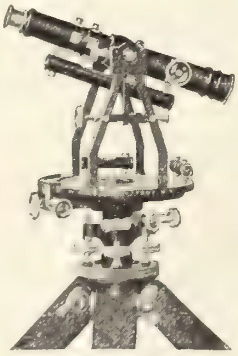
BUILDERS TRANSIT or ARCHITECTS LEVEL

to establish his lines and grades quickly and accurately.

Write for booklet illustrating and describing the use and adjustment of these efficient, practical instruments, which are guaranteed to give satisfaction. Their moderate cost will surprise you.



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VALVES

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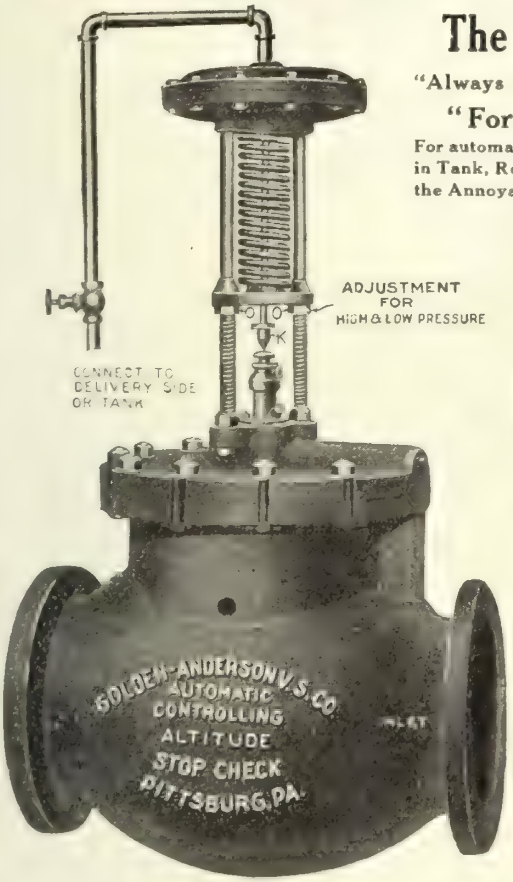

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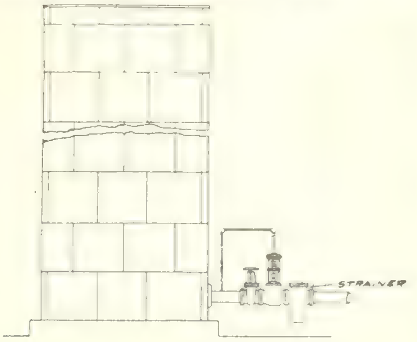

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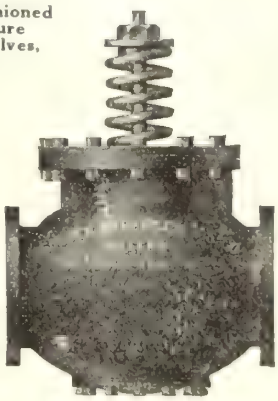

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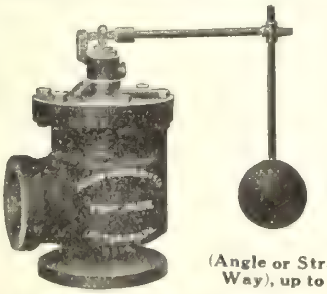

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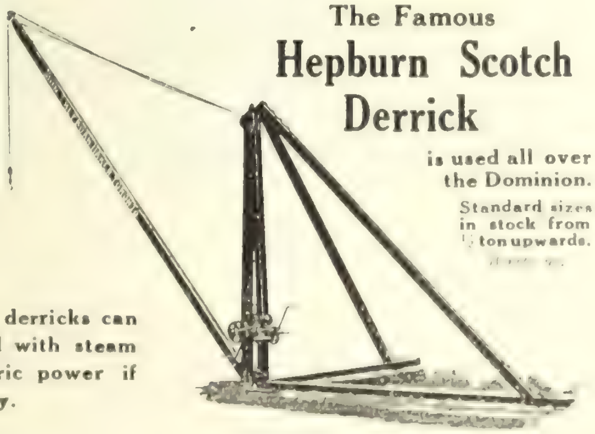

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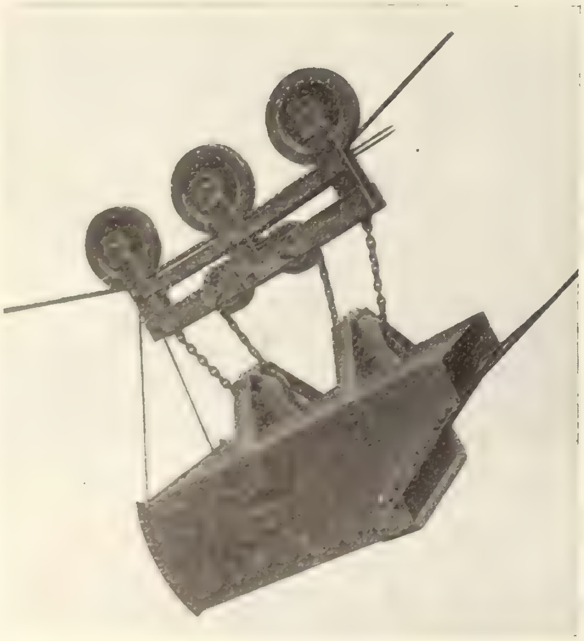

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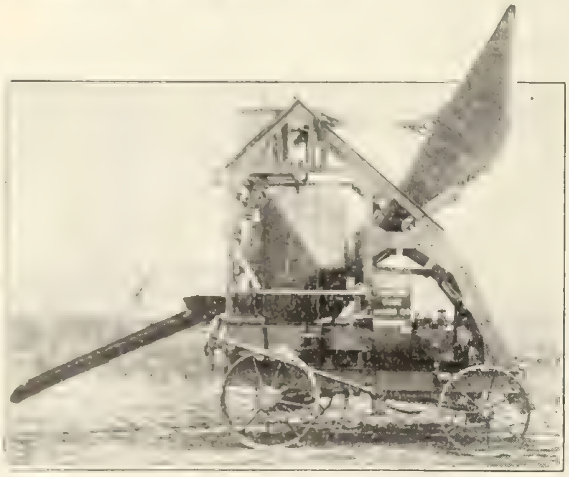

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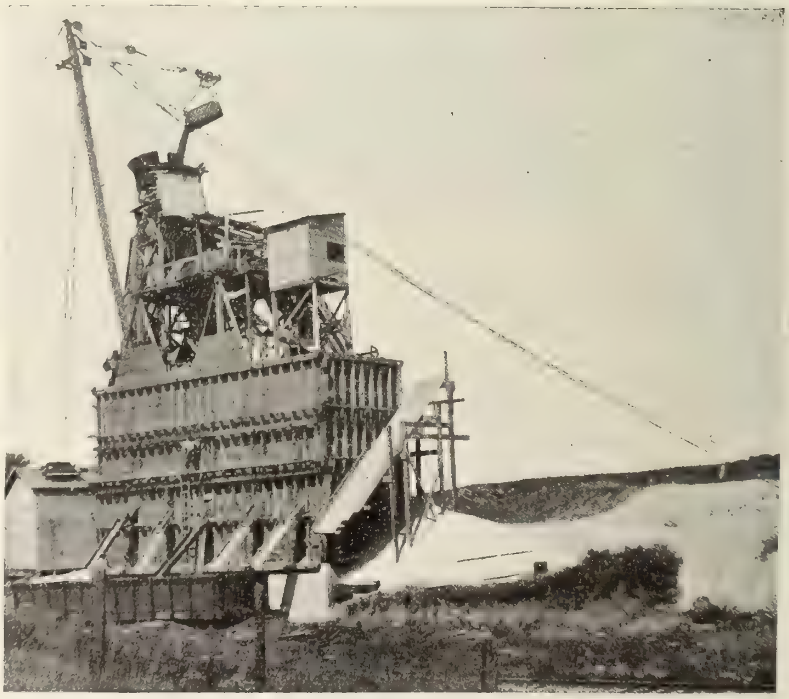

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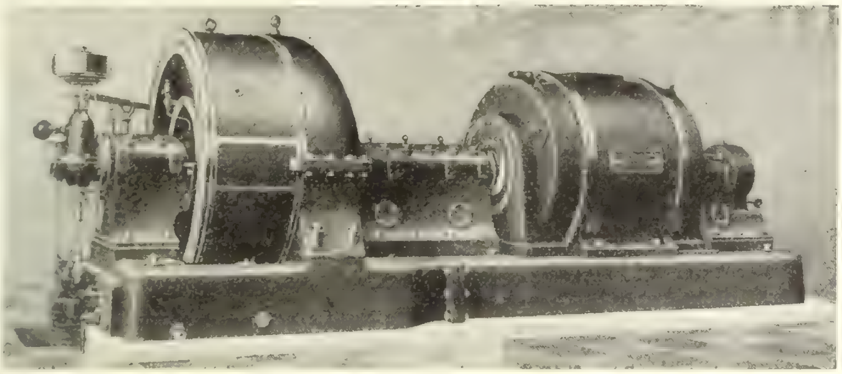

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HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - Tribune Building
CHICAGO - Tel. Randolph 6018 - 1155 Peoples Gas Bldg.
LONDON, ENG. - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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The Perfect Specification

THAT there is a lawsuit in every building contract (at the pleasure of the parties concerned) is an accepted axiom; hence, the contract is a document that is usually drawn up with considerable care and legal minds are not infrequently requisitioned in its preparation. When it comes to the specification, however, laxity is more honoured in the observance than in the breach. The classes are strung together one below the other, with but little regard to what has gone before or what is to follow. Repetition and tautology become wearisome, while an infinity of unnecessary detail prolongs the length of the document beyond the bounds of necessity. The fact is only too often overlooked that the specification is as much a legal document as the contract; indeed it forms, with the plans—and for the matter of that with the correspondence that ensues—a part of the contract, and the two must stand or fall together. Specification writing must be regarded as an important branch of the work of the engineer and the architect, and it is difficult to understand how the lamely-worded, halting, ungrammatical documents that one only too often sees can come from the pens of men whose calling presupposes the receipt of a fairly advanced education.

Clearness, brevity and consistency are the three things to aim at in writing a specification. Lengthy sentences of necessity become involved, and the snappiness of modern journalism may be followed with advantage. Reiteration of descriptions of similar work and materials does not, as is commonly thought, add strength to the document; and, too, there is ever the danger of dissimilar clauses on similar matters creeping in, to the confusion of all parties concerned. Tautology is to be avoided if possible, but true literary excellence is not to be attained and an expressive word or phrase had better be used over and over again if to ring the changes on it would mean any danger of confusion of ideas. A general clause to the effect that everything shall be done in the best and most workmanlike manner will save an infinity of that needless description of working processes which, to use the words of an authority on the subject, is often carried "to the verge of absurdity." Words such as "proper" and "sufficient" have practically no meaning at all, and the writer should avoid them by stating clearly and concisely what is proper and sufficient. Small detail sketches may be introduced in the margin with advantage, not necessarily as saving description but as helping to elucidate it; but even these may be overdone and "carried to the verge of absurdity" unless the writer places due restraint upon himself. "The description in specifications of workmanship and material of the highest class in positions which any practical builder knows to be unreasonable and unlikely to be insisted on," says the authority already quoted, "leads to a general system of discounting the written requirements by the experienced estimator, who tenders accordingly, and at a much lower rate than his deluded competitors, who weakly suppose that the specification means what it says." To sum the matter up: If the specification drafter clearly understands what he is writing about, says exactly what he means and not a word more, clearness, brevity and consistency will have been attained.

Many books have been published giving complete specifications or specimen specification clauses for both building and engineering works. Used with judgment such books may prove of the greatest service, but there is ever the danger of irresponsible consultation and the extraction of clauses which may, when strung together and read as a single document, have all the bad features that have been referred to above. Stock clauses to fit the requirements of every class of work cannot be drafted, and the architect or engineer who dabbles in such things may court serious trouble with his clients. Every clause must have precision of application, for incertitude is fatal. The wide tendering of which so much is heard is due largely to the atmosphere of uncertainty which attaches to many specifications. Two men may read a badly framed clause in two different ways, three men in three different ways, and so on; whereas a properly drafted clause should be of so definite a nature that it could convey but the one meaning, and that the meaning that it was intended by its writer to convey. Specification writing might, in fact, be reduced almost to an exact science, free from ambiguities and uncertainties, and offering no scope for the exercise of the "speculative" mind. Given a brief, clear and consistent specification, and a full set of quantities (with, of course the necessary drawings) and the tenders of a score of competent men need not vary to a greater extent than five or six per cent. As things are, fifty or sixty per cent. is not uncommon.

The Manager Plan of Municipal Government*

By Kenyon Riddle †

THE advantages of the manager plan of municipal government are being discussed in so many cities just now that the following notes on the subject from one who has had the benefit of some experience as engineer-manager of a small city may be of interest.

Since most of the affairs of the smaller cities, at least, are of an engineering nature, the city manager should be generally posted in engineering. Since he may act as an agent or arbitrator between the governing body and the people, he should be tactful. As a judge or adviser of a great deal of the city's business —such as purchasing material, allowing estimates, recommending improvements and expenditures, submitting ordinances and suggestions in general for the approval of the administrators—he should be familiar with cost data, a good judge of benefits derived from different acts, an economist, honest, impartial and free from politics, and in general be purely a business man and expert servant of the commission.

As to working principles, these can best be illustrated as follows. Imagine three (or five) horizontal lines converging to one central point, these lines representing the governing body; and diverging from this point the number of lines necessary to represent the different departments. The focusing of all the lines into one point shows clearly centralization of responsibility.

In order for any act to be executed, it must first be passed up by the legislative body as a whole, then condensed and made to pass through one point—the controlled executive—to the proper department heads. Now suppose the act was not carried out in a manner suitable to the people. They protest to the commissioners, whereupon, in order to save criticism, they go directly to this single head, and in order to hold his job he gets busy. And finally, when the blame is located, it may be found in some subordinate official of some department; however, the act is easily traced and finally filtered through the group.

The principal objection to this new plan is the fear of one-man power. The new plan eliminates one-man power. With the commissioners acting as a group, through one controlled executive, all of the fancies, hobbies or any peculiar ambition that one man might have are neutralized by the combined judgment of the other members of the commission. Also, if any one of the board is interested pecuniarily, the passing of every act by the group destroys all opportunities for such deals.

The manager is servant and executor, not boss.

Under the council form of government, there was confusion most of the time, due to jealousy among the councilmen, politics, special interests, lack of expert advice. Further confusion arose because the affairs of the city were divided and subdivided among the several committees and members and also because of complexity in general.

These same things may exist in a commission, but there is much less chance. Jealousy may exist, due to the fact that special charge of the different departments, etc., is divided among the commissioners. There is less danger from politics because the body is smaller in number and each man is more conspicuous. Special interests may be more detrimental under commission form because of each member having special charge over his departments. Lack of expert advice may be less dangerous because at no time does all of the board go out at once and the older members are apt finally to become posted on certain expert knowledge—at the city's expense. And finally, one of the greatest features in favor of commission form over the aldermanic or council form is the fact that an entire new body does not come in and spend the first few months of their administration tearing down what their predecessors have started. Also, since the majority of the cities do not lay much stress on records, it is possible for the remaining commissioners to put the new man wise to their past proceedings.

I maintain that it is possible for all of these objections to be eliminated, partially or wholly, by the engineer-manager plan. As a first step toward this end, a change should be introduced in the present laws of the various states, authorizing the commission plan, so that every act of importance shall be acted upon by the commission as a whole. For, with the two main ideas involved in the commission form—that is, the Lynn form (as in Lynn, Mass., and as has been adopted in Kansas) and the general plan (as in Galveston and Des Moines)—there is one great weakness, viz.: In the former electing its members to specific posts and, in the latter, appointing its members to perform special duties after they are elected. Both methods are accompanied by such objections as individual control, or as many different governments as there are commissioners, and in general lack of unity. Furthermore, no matter whether the commissioner is elected to his duties or whether these are assigned, it is hardly possible to get a true representative of the people (as the commissioner should be) when technical fitness has to be considered. Therefore, in order to avoid every objection which can be imagined from a lack of unity and individual action, elect the commissioners at large, make them responsible as a body, and make it necessary for every important act to be passed upon by the entire body, thereby balancing or equalizing the freak ideas that any of the members may possess.

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* Engineering News.

†Engineer-Manager, Abilene, Kan.

The next and, as already suggested, an equally important step, is to provide a manager (and for most places an engineer-manager) to serve the commission as an expert. In no case would it be policy for the state to define his duties. It is quite likely that the different towns or cities wishing to adopt the manager plan would have distinctly different views as to the duties of a manager. Some might make the qualifications strict as to his ability to regulate social matters, others might wish a manager of distinctive financial ability—but still the principal requirement should be experience and fitness in matters of an engineering nature.

It is quite evident that the duties of the city manager should be fixed by city ordinance. As a model for such an ordinance, suitable for the majority of places, the following is suggested:

An Ordinance

Creating the Office of City Manager, Defining his Duties and Salary. BE IT ORDAINED By the Mayor and Commissioners of the City of   :

City Manager: There shall be appointed by the Mayor and Commissioners a City Manager who shall be the administrative head of the municipal government subject to the supervision and control of the Commissioners and he shall be responsible for the efficient administration of all departments. He shall be appointed without regard to his political beliefs and may or may not be a resident of the City of   when appointed. During the absence or disability of the City Manager the City Commission may designate some properly qualified person to execute the functions of the office.

Powers and Duties of the City Manager: The powers and duties of the City Manager shall be:

(a) To see that the laws and ordinances are enforced;

(b) To attend all meetings of the Commission, with the right to take part in the discussion but having no vote;

(c) To recommend to the Commission for adoption such measures as he may deem necessary or expedient;

(d) To give all lines and grades for city improvements which require the same;

(e) To have control, management and direction of all improvement work of any nature which pertains to and comes under engineering principles. The above duties shall include the making of estimates, supervision during construction, inspection and the maintenance thereafter; he shall have control and management of all streets and alleys. He shall have charge of and control the entire water and sewer system and keep a complete underground record of the same.

(f) To be inspector of all wiring, sewer connections plumbing, water connections and chimney construction. He shall approve all estimates of the cost of public works, and recommend to the City Commissioners the acceptance or rejection of the work done or improvements made.

(g) To recommend to the Commission the appointment or removal of all heads of departments and all subordinate officers and employees of the City which come under and pertain to principles of engineering, all appointments to be upon merit and fitness alone.

(h) To exercise control over all departments and divisions created by the Commission.

(j) To keep the Commission fully advised as to the financial condition and needs of the City.

All the powers enumerated, however, shall be subject to the supervision and control of the City Commission.

Salary: The City Manager shall receive such salary as may be fixed by ordinance of the Commission.

All ordinances heretofore made so far as inconsistent and in conflict with this ordinance are hereby repealed.

Cracking in Concrete Roads

PROBABLY more criticism of concrete pavements is centered on the cracks which occur and expansion joints than upon any other features of this kind of construction. A. N. Johnson, state highway engineer of Illinois, in a paper before the American Road Congress attributed the formation of cracks to unequal settlements of the subgrade, supplemented by external stress due to the passage of heavy traffic or to the movement of the slab under temperature changes. In commenting upon this, Henry S. Spackman refers to experiments conducted by him which showed that when concrete is mixed as wet as it generally is in modern road work it shrinks during the first twenty-four hours and then expands during the next three or four months, the shrinkage being undoubtedly due to a draining out of the water and the expansion to the continuation of the chemical action, which continues for months and even for years in a continually lessening degree. In view of this shrinking which begins almost as soon as the concrete is laid, it seemed impossible to prevent the cracking of the pavements unless the exudation could be prevented. Mr. Spackman has experimented with the addition of hydrated lime for this purpose, and compared 18 test pieces to which hydrated lime had been added to the extent of 10 per cent. of the amount of cement in some instances and 20 per cent. in others, and 9 test pieces containing no lime. During the first twenty-four hours the average contraction for those containing hydrated lime was .007 per cent., as against .015 per cent. for the pieces containing no hydrated lime. At his suggestion also the Office of Public Roads laid a short stretch of road at Chevy Chase, Washington, D.C., using hydrated lime, and another was laid near Salisbury, Md. These experiments all lead him to believe that the addition of 10 to 15 per cent. of hydrated lime will be found beneficial not only in reducing cracks, but also in eliminating the formation of holes and soft spots. Such addition, he says, not only causes the mortar to hold the water, but the more plastic and viscous mortar eliminates the segregation of the cement from the sand and secures a more homogeneous mixture, lessening the liability of pockets of material deficient in cement.

Plowing up worn brick pavement, instead of employing a large gang with picks and crowbars, was the experiment successfully tried by a contractor in Louisville, Ky. The brick in the 1-mile stretch to be repaved was worn too thin to be of use in building construction, and its use as pavement foundation was prohibited. The contractor used a rooter plow, with a heavy point in place of the regular blade, propelled by a 10-ton steam roller, an unusual procedure, explained on the ground that the contractor owned no traction engine except the roller, which was idle at the time. This combination tore up half a block of street in from two to three hours, with a force of four or five men.

Recent Developments in Concrete Highway Construction*

By L. S. Bruner, Montreal

It is a generally accepted fact that any type of highway, which is considered permanent, must have a concrete base. Within the last decade, many communities have tried concrete, not only as a base but as a wearing surface as well. It is needless to say, however, that there were some cases which were not entirely satisfactory, but the successful results so far outnumbered the failures that this form of construction is now being adopted in all parts of the United States and Canada.

The early form of construction followed very closely the method then in vogue for the laying of concrete sidewalks. This is exemplified in the pavement laid by the city of Bellefontaine, Ohio, in 1893, and is probably the first of its kind in North America. The pavement consists of a machine mixed 1:4 gravel concrete base, four inches thick, and a wearing surface of a 1:1 mixture of Portland cement and clean coarse sand, two inches thick. It was laid in five foot strips starting at the curb, each strip being cut into blocks five feet square. In other words, the pavement has joints running parallel and perpendicular to the curb every five feet. The surface was finished smooth after the manner of sidewalks and then marked with V-shaped grooves about one-quarter of an inch deep every four inches transversely and longitudinally.

After twenty years service these pavements are in remarkably good condition, considering the meagre information at hand when they were built. The only failure has been along the longitudinal joints, which, in the light of later experience, have been found entirely unnecessary.

The next place where concrete for paving streets was used was Richmond, Ind. In a paper read at the 1910 convention of the N.A.C.Y., Mr. F. R. Charles, the City Engineer, says, "The City of Richmond, Ind., cannot claim to have a large amount of concrete roadways, but here some of the earliest street pavements of this construction were laid. The first roadway was built in 1896 and now has nearly 14 years of life and usefulness to its credit, and is still continuing its service without having cost one cent for repairs." This pavement consisted of a five-inch base of 1-2-5 concrete and a wearing surface of 1-2 mortar one inch thick. No more pavements were laid in Richmond until 1901, but since then a small amount has been added each year, and at the end of 1911 there was a total of 18,238 square yards.

Concrete Construction

Probably the most widely known concrete highways are those of Wayne County, Mich. This is no doubt due to their satisfactory results, modern methods of construction and comparatively large mileage, for out of a total of 116.221 miles, including tar and water bound macadams, gravel, brick, bitulithic, creosote block, rock, asphalt and concrete, 65.745 miles (or over half) are of concrete, of which about 35 miles were laid during the past year. In 1913 twenty-five more roads were built.

The first concrete road built in Wayne County in 1909 was on Woodward Avenue. It was approximately one mile long, with 18 feet of concrete and 3½ feet shoulders. Woodward Avenue is the main business and residential street of Detroit and extends northward through a prosperous farming community. It is subjected to a heavy and continuous automobile and farm waggon traffic. The method of construction used was a two-course pavement, of which the base was 4 in. thick, of 1:2½:5 limestone concrete with a wearing surface of 1:2:3 mixture, 2½ inches thick, of which the aggregate was sand and crushed field stone. Joints were placed every 21 feet and filled with various fillers including Georgian pine boards and certain bituminous compounds. Since the first road was built the methods have undergone several changes until at present it is the custom to use a 1:1½:3 gravel concrete mixed wet enough to pour. Joints are protected from chipping by steel plates, and expansion and contraction is provided for by filling between the plates with tarred felt. These joints are placed perpendicular to the axis of the road at intervals of 25 feet.

Before placing the concrete the subgrade is thoroughly rolled and 7-inch planks are laid 16 feet apart as side forms. Before receiving the concrete the subgrade is moistened and the concrete delivered from a batch mixer and deposited at the proper place by a bucket running along a swinging boom. The surface is shaped by means of a template cut to the crown of the road, 2 inches in 16 feet; after this two men operate a box tamper, and following them are two finishers. These implements, as well as a bridge upon which the finishers work, rest on the side forms which act as tracks. The finish is obtained with wooden floats. After the concrete is once shaped no one is allowed on it until it has fully hardened. It is then covered with tarpaulins, and when about twenty-four hours old these are removed and the surface sprinkled and covered with a layer of about two inches of dirt, which is kept moist for at least a week. In this way the concrete is not allowed to dry out quickly, thus preventing cracks due to shrinkage during setting.

As above stated, transverse joints are placed every 25 feet. They consist of two steel plates 3 inches deep, between which are two layers of tarred felt of a depth equal to the thickness of the concrete. These joints have the same crown as the road, and the whole is assembled by the side of the road and then staked in place with iron pins, which are removed after the concrete has been laid.

The concrete is allowed to harden for a couple of weeks before the road is opened for traffic, and after it is at least three weeks old, shoulders are rolled 4 feet wide on either side. Drainage is provided for by ditches or drain tile, or a combination of both.

That these roads are satisfactory is proved in several ways. First, the people, especially the farmers, are anxious to have more of them. Second, the sixth Annual Report of the Board of County Road Commissioners of Wayne County states, "Wayne County has received some very flattering commendations on her

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*Read at a meeting of the Canadian Society of Civil Engineers, Montreal, April 9, 1914.

Levelling process on concrete road work at Winnipeg.

Construction of Grand River road, Wayne County, Mich.

concrete roads during the past year, and we have been visited by and received request for information from upwards of 1,000 Highway Engineers, Road Commissioners, Mayors and others interested in good roads and streets. All over the country communities are putting down concrete roads, streets and alleys, using practically our specifications and methods." Third, Mr. E. N. Hines, who has been a member of the Board for several years and who is one of the main sponsors for these roads, was re-elected last November by an overwhelming majority.

The cost of the roads has varied from $1.04 to $1.70 per sq. yd. or at a rate of from $9,762.14 to $15,956.34 per mile of road, which includes everything connected with the construction of the road, but is based on yardage of concrete only.

In this vicinity there is an example of this type of construction: In 1912 the Quebec Highway Department authorized that portion of the King Edward VII. Highway passing through Napierville, Que., be built of concrete. The specifications of Wayne County were followed as nearly as possible, the main variation being the joints. These were made narrower and the steel plates were eliminated. The joints were made by folding a piece of 3-ply tarred felt around a steel plate. The whole was staked in position and the concrete deposited up to and three feet beyond the joint. The plate was then withdrawn and the concrete tamped back against the paper, thus closing up the space left by the plate and making a joint very little wider than ⅛-inch.

Our methods of construction have been used, including two course pavements of reinforced concrete and several patented forms, viz., Hassam, Blome and Dolorway.

The Hassam pavement consists of several courses of different sized stones which are deposited, grouted and rolled. Each succeeding course is placed on the preceding one before it has set and the surface finish made with screenings which are also grouted and rolled. The construction is very similar to a water-bound macadam which has a cement grout rolled in. This method of construction has since been changed. Now only one course is laid of uniform size stone about 2 in.—with no screenings. This leaves plenty of space between stones so that the grout is able to penetrate the whole pavement without obstruction.

The Blome pavement is made in two courses, the base being about 5 inches of 1:2½:5 concrete and the top of 1:2 mixture of cement and granite, not thicker than ½-inch. This wearing surface is composed of fixed proportions of various sized aggregates and is marked into blocks about 4 x 9 in. by grooves running longitudinally and transversely. An example of this kind, with which many are no doubt familiar, is the pavement laid by the Montreal Tramways Company on St. Catherine Street West.

The Dolorway pavement consists of a concrete base with a wearing surface of bitumen and sand. The bitumen is spread on in a hot state to a thickness of ¼ to ⅜ of an inch, and upon this is sprinkled sand, giving the street the appearance of sheet asphalt.

In order to obtain the most satisfactory results with this type of construction, the following details should be given careful attention. The sub-grade should be well drained and compacted and be in a

Template tamper in use on the Grand River road

Assembling joint with steel protection plates damp condition when the concrete is deposited. The aggregate should be clean and well graded. The mixing should be uniform in order to give the pavement uniform strength. The concrete should be mixed rich enough to resist abrasion—not leaner than 1-2-4. The surface should be given a wood float or broomed finish to prevent slipperiness, should not be allowed to dry too quickly while hardening, and either a very narrow joint should be made or the edges of joints protected from chipping by some form of steel plate.

The advantages claimed for concrete roads are as follows:—They are low in first cost, averaging about 10 per cent. more than macadam and less than other forms of permanent pavement. They are easily and cheaply maintained. They are, in themselves, dustless as there is do detritus from their wear, making them easily cleaned and sanitary. The hard even surface affords the lowest resistance to traffic and the rough finish gives a good foothold for horses and prevents skidding of automobiles.

Light Floors for Highway Bridges

Wood Block, Bituminous Wearing Surface and Plank to Meet Various Conditions of Traffic

THE Illinois State Highway Commission, in its annual report, gives some suggestions concerning floors for steel highway bridges which would seem to answer a problem of more or less general occurrence if we may judge by inquiries received. The discussion, somewhat abridged, is as follows:

The largest item of expense in connection with the upkeep of steel bridges not having concrete or other permanent floors, is that of floor maintenance. Until a few years ago, the floor almost universally specified for country highway bridges consisted of white or burr oak plank, from 2½ to 3 inches in thickness. When first-class material could be obtained at a cost of $25 per thousand feet board measure, such floors proved to be fairly economical if not subjected to heavy traffic. But now it is almost impossible to obtain at any price a good quality of white or burr oak bridge plank.

The lightest concrete floor that can be designed to carry modern traffic with safety weighs 40 pounds or more per square foot, and in order to protect such a floor from excessive wear and to distribute concentrated loads sufficiently so that they will not produce local failure, a wearing surface of gravel, macadam or brick weighing a minimum of 50 pounds per square foot is necessary.

Steel bridges carrying plank floors are rarely, if ever, designed to carry more than the dead weight of the bridge itself, which includes about 12 pounds per square foot for the floor, and a live load of 100 pounds per square foot, provided by law.

To place a concrete floor on a steel bridge, designed to carry a plank floor, would impose, therefore, an additional dead load on the structure amounting to the difference between 90 pounds per square foot, the weight of the concrete floor and wearing surface, and 12 pounds per square foot, the weight of a plank floor, or about 78 pounds per square foot.

The proposed floor must weigh but little more than the floor for which the structure was designed; it must not be unduly expensive, and it must be as durable as possible.

The material which best meets these requirements seems to be timber treated with creosote oil to prevent decay. All woods treated with creosote oil seem to resist decay equally well. Any wood may therefore be used which is susceptible to the creosote treatment and which will resist the wear coming upon it.

For existing wood floor steel bridges, located in or near cities, which carry a considerable amount of traffic, it is recommended that a creosote wood block pavement be laid on creosoted pine sub-plank. Such a floor weighs about 30 pounds per square foot. This is about 18 pounds per square foot in excess of the floor weight a majority of wood floor steel bridges are resigned to carry. However, as this type of floor is very much smoother and stiffer than the ordinary plank floor, the reduction of vibration due to heavy moving loads is greatly decreased. This is a factor of safety which will balance somewhat the greater dead weight of the structure. However, a careful investigation of the strength of the bridge should be made before a floor of this character is laid.

At present prices for material this type of floor can be laid for about four times the cost of a 3-inch plank floor. If proper materials and workmanship are used, there is little question but that such a floor will last 12 years or more, possibly 25 or 30 years.

For existing bridges in good condition and of proper design, located on roads at some distance from a city, carrying a moderate amount of traffic, a floor consisting of 3-inch creosoted sub-plank on which is placed a wearing surface about three-quarters of an inch thick of fine gravel or stone chips flushed with heavy asphaltic filler will be found serviceable and economical. Such a floor, if properly constructed, will present a smooth, elastic surface which will reduce vibration. A floor of this character weighs but a few pounds per square foot more than a 3-inch oak plank floor and is far more durable. The wearing surface will probably require renewal at intervals of from 2 to 6 years, depending upon traffic conditions. As the wearing surface may readily be renewed by day labor, at a cost of about 50 cents per square yard, the item of maintenance is small compared with the cost of maintaining an untreated plank floor. There is no reason why a floor of this character should not last as long as a creosoted block floor, providing the sub-plank is kept protected from wear by a properly maintained wearing surface.

For existing country highway bridges, in good repair and of sufficient strength, where traffic is light and little wear comes upon the floor, creosoted oak plank with no special wearing surface can often be used. Red oak can be used to advantage for this purpose, as it is readily susceptible to treatment with creosote oil, wears less than a softer wood and will probably last as long as far as decay is concerned as any other creosoted timber.

In this connection it is worthy to note that the rate of wear on an ordinary plank floor greatly increases with the age of the plank, owing to the softening of the wood as decay advances. As the creosote treatment protects the plank from decay, a floor of this character will wear better than a floor of untreated material, as the wood remains hard and resistant until decay sets in.

In the light of the above discussion it is therefore well to hold in mind the following points:

1. Old steel bridges are rarely, if ever, strong enough to carry with safety a concrete floor.
2. For existing steel bridges in good condition and of satisfactory design, located in cities or elsewhere where traffic is heavy and ordinary plank floors rapidly wear out, it will be found economical to refloor with creosoted sub-plank and creosoted blocks.
3. For existing steel bridges in good repair and of satisfactory design, carrying moderate traffic, but yet where wear is of considerable importance, it will be found economical to use creosoted plank with a bituminous wearing surface.
4. For existing steel bridges in locations where an ordinary plank floor rots rather than wears out, a creosoted plank floor with no special wearing surface will be found economical.

If a proper selection of floor is made, and the material used is subjected to rigid specifications and inspection, this floor should in most cases outlast the steel bridge on which it is placed.

Progress Records on Sewer Works

THE engineer in charge of constructing the intercepting sewer and the sewage disposal plant in Schenectady, N.Y., is keeping a graphic record of the progress of construction which is useful not only to his office in showing at a glance just how the work is progressing, but also to enable a council committee or any interested citizens to appreciate this with a clearness which figures might not give.

The general method is shown on the accompanying illustration of the interceptor record. The work as plotted on the left hand side of the chart is divided into three parts—the underdrain, the concrete invert, and the sides and top of the sewer. The entire line of the sewer is first laid out by stations, running from zero up to 82 + 50, the space between the lines representing the structure being left open, as shown in the vicinity of station 33 in the illustration. A different color is chosen for each month, the five months of August to December being shown. At the end of each month the section or sections of the sewer completed during that month are filled in with this color. As may be seen, sub-drains are laid in certain sections only and are not continuous throughout the sewer. The diagram also shows that at the end of each month the invert had been carried somewhat ahead of the barrel of the sewer, as would naturally be the case. It appears that at the end of December the sewer had been completed, except that two openings, from about station 31 to 37, and from about station 44 plus 75 to station 55, had been left open because of certain difficulties which could be overcome better later on, as after emptying of the canal, for instance.

At the bottom of the diagram is shown the percentage of work completed at the end of each month, this showing that about 81½ per cent. had been completed on December 31.

At the right hand end of the sheet is another set of diagrams, these being vertical columns showing the amount of work done each month on the several items of the contract. Beginning at the left hand end these columns refer to sewer type A; sewer type B; manholes; cast iron pipe; tile underdrain; rock excavation; extra earth excavation; extra earth fill; extra broken stone fill; lumber in foundations; lumber in sheathing; extra concrete, and extra steel. In this case a different scale is used for each column, adapted to the units upon which the bid was based and the total amount of work which is to be recorded. Different colors are used to represent the work done during the different months.—Municipal Journal.

Lumber cut in British Columbia in 1913 totalled 1,348,000,000 ft. b.m., exclusive of piles, poles, posts, etc., according to a recent report of Mr. H. R. McMillan, provincial forester. He estimates that the Government revenue on the 1914 cut will be $3,000,000.

Chart for recording progress of each feature of construction work

The Modern Type of Cement Gun and Its Work[*]—Part I.

By Carl Weber

THE Cement Gun is a machine invented about six years ago for the purpose of "shooting" a coating of cement mortar or the like onto construction surfaces, as, for instance, on concrete, brick, tile, wood and steel work. The gun is operated with compressed air. The mortar is deposited in a uniform coat with so great a force that it not only adheres to new and old surfaces with the utmost tenacity but it also expels by its impact all superfluous air and water, and in this manner becomes so dense that it is an excellent waterproofing medium. If used on interior or exterior wall surfaces the finished product resembles cement stucco and, as a matter of fact, the original purpose and the first work to which the cement gun was applied was the production of such work. It soon became apparent, however, that the product of the cement gun was superior to handwork and that the material displayed qualities which put it in a class by itself. Therefore in order to distinguish the cement gun product from all other classes of cement work, the name "Gunite" was adopted.

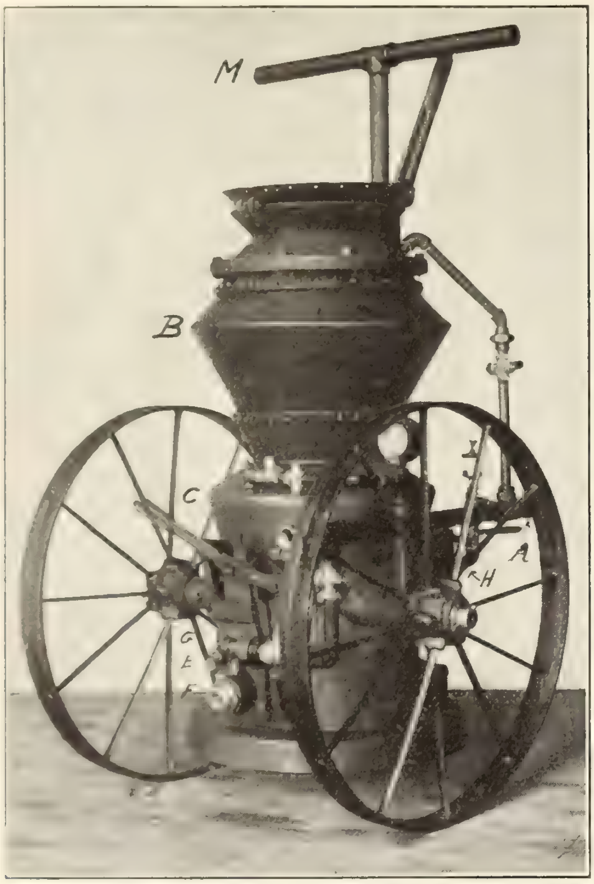

Fig. 1.—Modern type of cement gun.

Although the first principles were proven to be absolutely correct, the form of the machine and the method of operating it have been greatly improved. The greatest advantage of the new cement gun is its increased working capacity, which is about three times as much as that of the older type. The light weight of the new gun and the convenient arrangement of all its working parts also help very materially to reduce the cost of work. Cement guns have been used on the Panama Canal, the New York Central Terminal Station, the Woolworth Building, the Croton (N. Y.) Aqueduct, construction of large reservoirs in San Francisco and Nashville, in the Hawaiian Islands, for viaducts in Spain, and other work.

The cement gun fills an important field in engineering work for waterproofing, protection of steel, the lining of tunnels, reservoirs, shafts, ditches and canals, etc., and the repairing of disintegrated concrete, masonry and brick work. Although there is still a large amount of gun stucco work done on ordinary building construction, the engineering work is now decidedly predominant.

Operation of the Cement Gun

Fig. 1 illustrates the modern cement gun in working position. If to be moved, the machine is tilted over and by means of the handle bars, M, it is wheeled about like a cart.

The air line from the compressor is connected at A to the main air pipe, which by its branches conveys the air to the motor H, driving the feed wheel to the lower C and upper B material hoppers and to the main outlet valve GEF. At different points in the air lines the necessary cocks, check valves, boilers and pressure gauges are provided as shown.

The operation of the gun is simple. Fig. 2 shows a vertical cross section. The inside construction and the method of operation are easily understood from this drawing.

The material, which has been previously mixed dry in the right proportion, is thrown into the upper receiving hopper B which has a capacity of about 3 cu. ft. Then the upper cone valve is closed and compressed air is admitted so that the air pressure in hoppers B and C become equal.

By the weight of the material, the lower cone valve opens and admits the material into the lower hopper. Then the lower cone valve is closed. An air outlet valve in hopper B emits the compressed air and hopper B is ready for another charge.

In this manner the lower hopper C is always under equal pressure and continuous operation of the gun is made possible.

At the bottom of hopper C there is the cone-shaped feed wheel D, which has a number of small pockets equally spaced on its outer edge. This feed wheel is gear-connected to the air motor H, which keeps the wheel in continuous rotation. As the feed wheel rotates, it carries in its pockets measured quantities of material into the stream of compressed air entering at E, which blows the material into the delivery hose connected at F. The pockets on this feed wheel are so arranged that before the material is entirely fed out of one pocket, the feeding begins from the next one, so that the flow of material is smooth and even. J is an agitator revolving with the feed wheel. K is the large gear wheel connecting the air motor H. L is the foot rest and G is the shut-off valve with a by-pass which automatically cleans the hose.

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[*] Abstract and re-arranged version of a paper presented last month to the Western Society of Engineers, Chicago, and published in the April journal of the Society. In co-operating with the Editors of the Contract Record in the reproduction of this paper (in two parts, in the issues of April 29 and May 6), Mr. Weber kindly offers to deal directly with any enquiries through our correspondence columns.

With the lower tank full of material, the operation of the machine proceeds as follows: Air is admitted to the air motor which starts the feed wheel in motion; the air line to valve G is then opened, but as the slide is closed the air does not enter the machine but escapes through the by-pass in the body of the valve out through the material hose, cleaning the hose and creating a suction which prevents clogging on opening the valve slide; this slide is then opened and the material begins to discharge at the nozzle.

The delivery hose is made of pure soft rubber covered with heavy canvas and may be 300 ft. in length and even more. It is usually made up in sections of 50 ft. each, united by special metal couplings. At the end of the hose line is the rubber-lined metal nozzle, which is also connected to a water hose in such a manner that a fine spray of water is added to the material as it rushes through the nozzle. A small screw valve enables the nozzle man to adjust the amount of water needed for the proper hydration of the material.

It is characteristic of the cement gun, and of greatest importance for the quality of the work, that the material is delivered "dry" through the machine into the nozzle, and that the necessary water for hydration is added at the moment of deposit. The hydration of the material really takes place in the air between the nozzle and the place of deposit and any loss of the binding power of the cement in transit is absolutely avoided. The initial set of the cement takes place on the structure and not in the mortar box. Another very important factor of the cement gun process is that only the proper amount of water for perfect hydration can be added because all superfluous water is expelled automatically by the force of impact of the material at its place of deposit. If we consider that the air in the cement gun does not act as a plunger in forcing the material through the delivery hose but carries the materials by suspension and skin friction, we can easily understand that only a dry material can be successfully conveyed by air pressure and that only a machine shooting dry material can be self cleaning and free from clogging and excessive wear.

The air consumption of the cement gun is very economical. An air compressor delivering about 40 cu. ft. of compressed air at 45 lb. pressure, which is equal to about 150 cu. ft. of free air per minute, is sufficient for the ordinary working capacity of the gun of say 1½ cu. yd. of dry material per hour. A larger volume of air at higher pressure will greatly increase the capacity up to a maximum of about 4 cu. yd. per hour. The working capacity of the cement gun depends upon many different factors. The experience of the crew, the kind of work to be done, and the method and thickness of the coating must be taken into consideration. The distance of delivery and the height of elevation, however, are of minor importance. As stated before, the capacity of the cement gun is up to 4 cu. yd. per hour, but if a thin coating is applied it is, of course, impossible to utilize more than a fraction of the gun's capacity under actual working conditions.

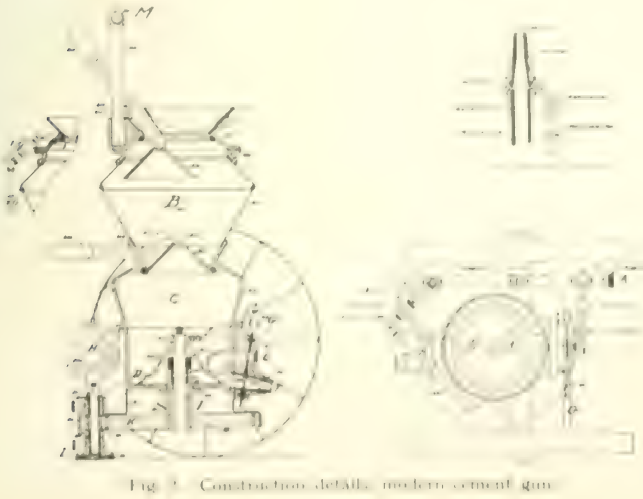


Fig. 2. Construction details, modern cement gun

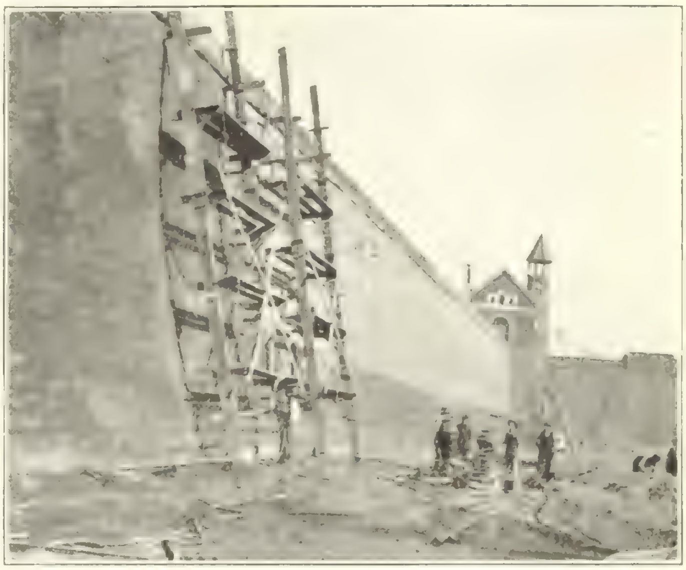


Fig. 3. Cement gun in operation at Nashville.

In Fig. 3 the cement gun is shown in operation on a reservoir lining at Nashville, Tenn. The picture clearly shows the location of the gun, the working crew, and the form of movable scaffold used on the job. The upper man on the scaffold is handling the nozzle and the two different lines for water and material uniting at the nozzle can be readily distinguished. The workman on the bottom is cleaning the surface by washing it with a water jet of high pressure. The air compressor may be located wherever most convenient. It may be at practically any distance from the gun. The connection is made by a flexible hose or a pipe line, and although there is a certain loss of air pressure due to friction in the line, in practical work this can easily be compensated for, and the loss is a negligible amount.

Before the cement coat can be applied, it is usually necessary to clean the surfaces and different methods must be used to meet the special requirements. While scum and dirt in reservoirs can often be washed off, it is at times necessary to use a sandblast for this purpose; especially is this true on steel work. Before old masonry, concrete, or brick work can be coated, it is frequently necessary to deepen the joints or even roughen the entire surface removing all loose and decayed particles from the structure. For such work the cement gun process is doubly advantageous for the reason that the gun in itself is a most effective sand blasting machine. Both dry and wet sandblasting is done most advantageously with the cement gun while the powerful airblast can be utilized for removing loose dirt and dust. Air tools of all known varieties can be connected to the pressure lines and the flexible hose connections allow access to even the most concealed corners which could not be reached by any other method.

A good soft rubber lined hose for this gun will give over a month of continuous service if used with care. For longer transportation lines and in straight sections which are not moved frequently steel pipes may be used. For curved sections, however, rubber hose is imperative, as a curved steel pipe will be worn out after a few hours' work. The rubber lining of the nozzle will last from one to two weeks. Without this lining the brass nozzle end would be destroyed in a short time. It is necessary that the hose be made of the most flexible pure soft rubber. Although such a hose is considerably higher in price than the ordinary varieties, it is by far the cheapest in operation owing to its lasting qualities.

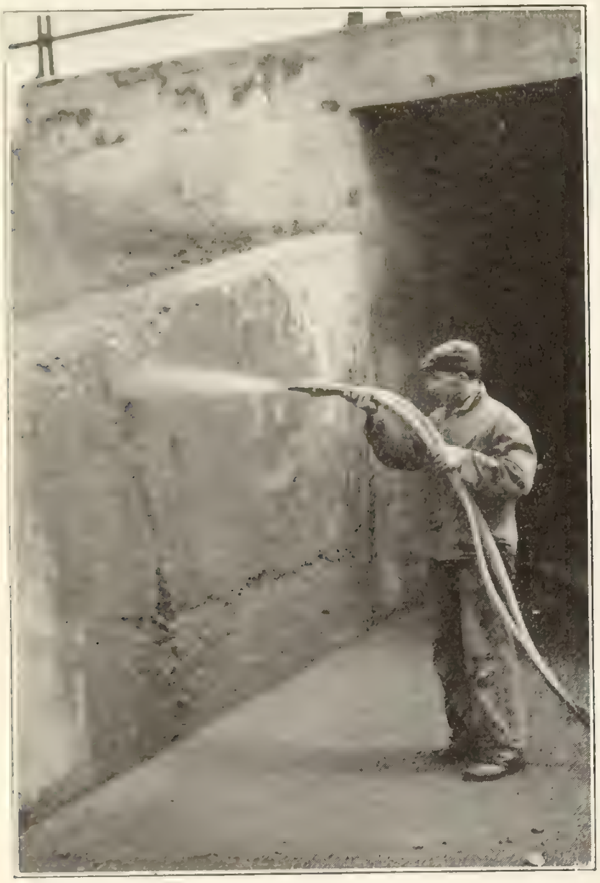


Fig. 4.—Gun nozzle in operation.

For general information it may here be added that the weight of a cement gun is about 1,100 lbs. Its height to the top of the upper hopper is 54 in. The wheels are 36 in. high, and the extreme width is 37 in. The air line from compressor to gun is usually 1¼ in. in diameter. The material hose is from 1 in. to 1½ in. inside diameter and the water hose to the nozzle is [illegible]

The air pressure is from 35 to 45 lb. per sq. in. and although an air compressor of about 100 cu. ft. capacity (free air) would suffice for all ordinary work, it is advisable to use a compressor of about 150 to 160 cu. ft. capacity. The cost of operating the larger compressor will be very little higher and is more than compensated for by the increased efficiency of the cement gun. A motor from 20 to 25 h.p. will be necessary for operating this compressor, and gas, steam, or electric power may be used as conditions suggest.

The working crew of the gun usually consists of four to six men, which are a foreman, two or three material men at the gun, and a nozzle man. This is all that is necessary for ordinary work. If, however, reinforcement is to be placed, or a special finish or surface preparation is required, the number of men must be correspondingly increased.

Gunite

Gunite is usually a cement mortar composed of about one part of Portland cement and three parts of coarse, sharp sand passing through a ⅜-in. screen. Although other compositions may be used and hydrated lime or any other ingredients may be added, it has been found in practice that the one-to-three cement and sand mixture is the most advantageous and efficient.

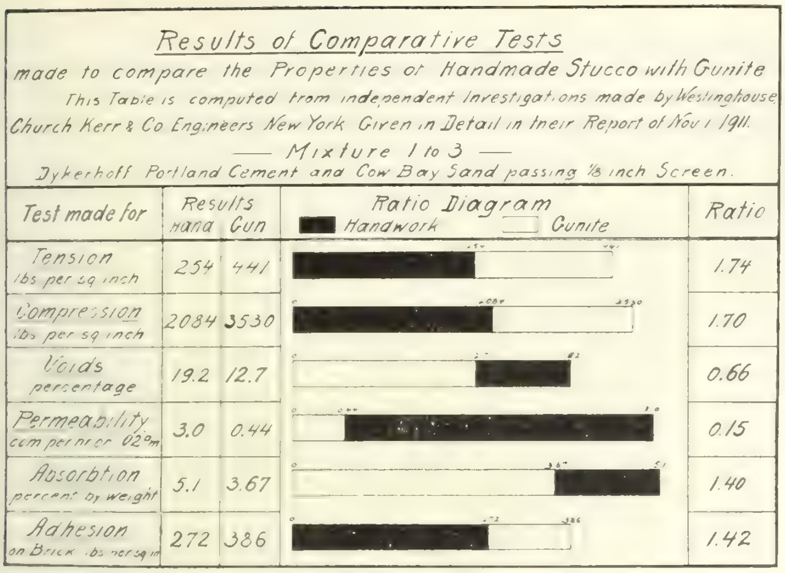
For ordinary stucco work on buildings, a one-to-four mixture is often sufficient, and even a still weaker mixture with a small percentage of hydrated lime added can be used if desired, or if utmost economy must be used on the work. For engineering work, however, the cement-sand mixture of one-to-three is mostly used without the addition of anything else.

To understand the advantages of gunite over ordinary cement work, it is necessary that we follow the process of formation of the deposit as it occurs on the surface to be coated. Fig. 4 shows the nozzle in action, and the method of shooting is clearly demonstrated in this view. After the wall surfaces have been prepared for the gunite coat by cleaning, or whatever other preparation such as tooling or the like was necessary, and after the reinforcement which is provided for the work has been placed, the stream of material is directed against the surface as shown.

The material leaves the nozzle with a velocity of about 300 ft. per second and as it strikes the hard surface the sand will rebound and fall down. Only the neat cement will first adhere until a coat thick enough to hold the sand has been formed. Then the rebound stops almost entirely and the coat is built up grain by grain until the required thickness has been attained. In this manner a film of neat cement is formed automatically between the old and the new work on every inch being covered, thus sealing every pore. Not only on the surface itself but also around every reinforcing bar or wire the same process takes place and thereby a bond is secured which cannot be obtained in any other way. No matter what kind of a surface is being covered, steel or wood, stone, concrete or brick, the first film of neat cement is sure to be there regardless of the amount of sand added to the cement mixture.

This point is of great importance and every engineer or architect will fully appreciate its value. We all know how difficult it is to bond cement to old surfaces that only an even coat of neat cement can give any assurance of success. In handwork, even in spite of most rigid specifications and inspection, it is practically impossible to get this bonding film applied in the proper manner and in the proper time. If applied at all it must of necessity be done ahead of the other work and be partially set before the actual coating is done, or even dry out and become worse than useless.

By the cement gun process this coat is formed automatically at the only moment when it is effective, and the most careless nozzleman could not omit it, even if he were paid a premium to do so. This bonding film



Results of Comparative Tests
made to compare the Properties of Handmade Stucco with Gunite
This Table is computed from independent Investigations made by Westinghouse Church Kerr & Co Engineers New York Given in Detail in their Report of Nov 1 1911.
— Mixture 1 to 3 —
Dykerhoff Portland Cement and Cow Bay Sand passing 1/8 inch Screen.

Test made for	Results Hand	Gun	Ratio Diagram ■ Handwork ☐ Gunite	Ratio
Tension lbs per sq inch	254	441		1.74
Compression lbs per sq inch	2084	3530		1.70
Voids percentage	19.2	12.7		0.66
Permeability ccm per hr or 02 °m	3.0	0.44		0.15
Absorbtion percent by weight	5.1	3.67		1.40
Adhesion on Brick lbs per sq in	272	386		1.42

Table 1.

of neat cement is characteristic of gunite and is inseparable from its application.

As the "shooting" continues this forcing ahead of the neat cement by impact is continuously repeated, and every grain of sand which does not find a perfect bed or which is not immediately enveloped with cement will rebound and be forced out. Any pores remaining will be immediately filled by the following mass and all air and surplus moisture is forcibly ejected.

The amount of water in the mass is regulated automatically under all temperatures and weather conditions. If not enough water is used the gunite coat cannot adhere and all surplus moisture is expelled as demonstrated before. All the water regulation required by the nozzleman is to see that the gunite coat sticks without running; the rest is taken care of by the gun. The resulting gunite coating must therefore be uniform throughout, of greatest possible density, and of 100 per cent. efficiency.

Another factor of great importance is that gunite forms a perfect bond to the reinforcement which has been inserted in the coating, and at every place intimate contact between steel and concrete must exist. if, for instance, a thin cement coat is plastered by hand over a wire mesh or other reinforcement, the action of the float and trowel causes continuous jarring and vibrating of the steel within the cement mass, which is still further emphasized by the elasticity of the reinforcement and the suction under the trowel. In numerous places around the wires or bars, open spaces will be formed in which the wires lies without contact with the surrounding concrete. In gunite this is impossible for the reason that the mass is built up around each individual piece of the reinforcement without the slightest vibration, and a loosening of the steel within the coating is impossible no matter how thin the same may be applied.

These facts have been confirmed by field and laboratory tests by Messrs. Westinghouse, Church, Kerr & Company, engineers, New York. The tests were made to compare the qualities of handwork with gunite.

"In all of the tests made the product of the cement gun showed superior to good hand-made products of the same kind. The degree of superiority varied between wide limits. In tensile strength the gun work excelled hand work in every case by amounts ranging from 20 to 260 per cent. In compressive strength the excellence of the gun work was even more marked, ranging from 20 to 720 per cent. better than hand work. In the matter of surface permeability the gun work absorbed from 7-10 down to 1-20 as much water per hour, per unit of area as the similar handmade surface. As regards absorption of water, the hand-made mortars took up from 1.4 to 5.3 times as much as the gun-made mortars. The percentage of voids of the gun-made product ranged from 52 to 75 per cent. to that of the hand-made product. The adhesion of the gun-applied mortars was on an average 27 per cent. better than that of the hand-work."

In order to show, in condensed form, the comparative values of results of these tests, I have made a ratio diagram for the one-to-three mixture as given in Table I. In column 4 the black section indicates handwork and the light section gunite.

These tests, although they greatly favored the handwork, prove conclusively the superiority of gunite. The hand-made specimens were made with extreme care by expert union plasterers working under ideal conditions so far as material supply and everything else was concerned.

Consider for a moment how even the best hand stucco or plastering work is done in actual practice. Under most ideal working conditions it will be from fifteen to thirty minutes before the mortar is taken from the mixer to the wall. By the cement gun process the material is deposited within a fraction of a second after the water is added.

The cement gun gives a perfect bond and forms a

Fig. 3. First Baptist Church, [illegible]

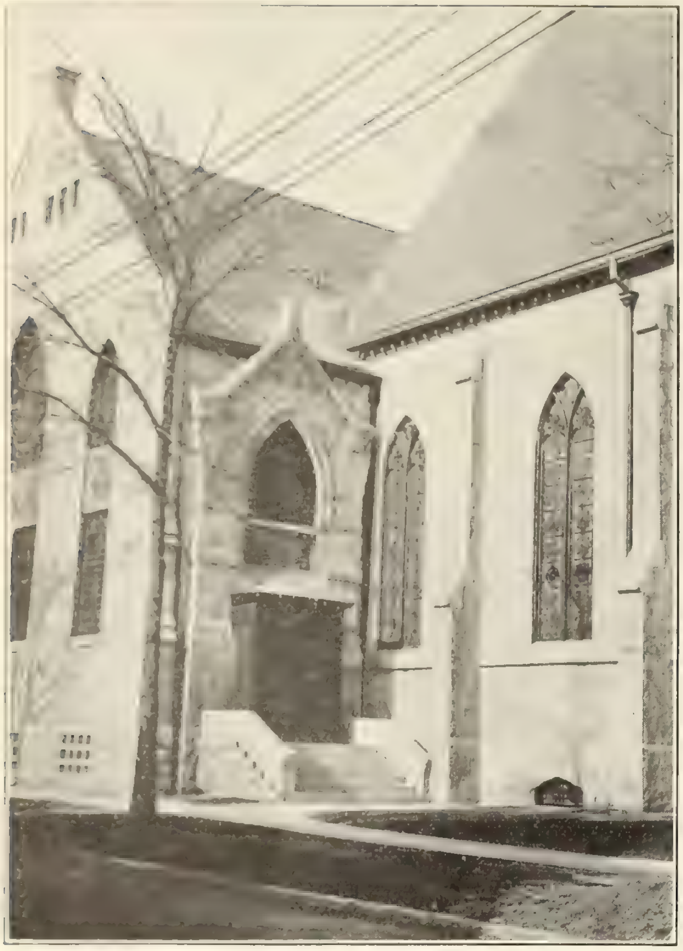


Fig. 6.—First Baptist Church, Evanston.

coating of a density which it is impossible to produce by any other known method.

Cost of Gunite Work

There is a great difference in weight between hand made concrete and gunite. Numerous tests have been made to ascertain correct values and it was found that the average weight of best hand made stucco after twenty-eight days was 131.04 lb. per cu. ft., while the weight of gunite made of the same mixture is 154.8 lb. Gunite is therefore 18.1 per cent. heavier, and of course requires correspondingly more material. In estimating gunite work this difference must be considered and also the loss of sand caused by rebound as mentioned.

The amount of rebound varies, depending upon different factors, as, for instance, kind of surface to be covered, thickness of conditions, etc. The loss will vary from 5 per cent. to 30 per cent., and although in most cases the sand itself is recovered and used again, the loss must be compensated in the original mixture so as to get the desired results. The amount of work which a gun will accomplish in an hour and its cost depends on so many different factors that it is impossible to estimate without definite data. As compared with handwork, we find that on large jobs the cost of a gunite coating is much cheaper, while on small jobs, where the initial expenses are high or where the equipment must be shifted frequently, the cost may be somewhat higher.

In many cases, however, it will be practically impossible to make any comparison with handwork for the reason that most of the work done by the cement gun, especially on engineering structures, cannot be done by hand. Even in plain stucco work, where practically standard methods are employed, the gun has a great advantage over other methods for the reason that a much lighter coating can be used. A ½ in. gunite cover is fully as efficient as a 1 in. hand stucco, and the saving in material will often more than equalize the cost of installing the apparatus.

Handling of Cement Gun Equipment

The cement gun is not more complicated than any other machinery used on construction work. In order, however, to get the full benefit from the machine it is necessary that at least two experienced men be employed with every gun. The first one acts as a foreman, and must know how to rig-up and manage the work for best results He must be able to take good care of his machine, men, materials and supplies, and should also have had enough experience with carpentry work to build such light scaffolds, swings, and forms as may be required for the work. The second man must be a good nozzleman, have a steady hand and a keen eye, and be quick in his movements. A poor nozzleman will waste considerable time and material, and although he cannot spoil the quality of the work, he may do great damage to the appearance of the same. On his skill depends the cost of the finishing work and the amount of material used. This, of course, applies to most any line of work. Buying a set of carpenter tools does not make a carpenter, and getting a set of drawing instruments does not make a draftsman. It is the experience and skill behind the tools which make them valuable. It is therefore important, in placing orders, to see that the work is done by experienced operators.

The Working Field of the Cement Gun

Within the last few years several distinctly different lines of work have been developed by the cement gun, and some of the more important branches of this work is here illustrated and described. A large number of brick, tile, stone, and wooden buildings have been coated with gunite with great success.

In Figs. 5 and 6 two views of the First Baptist Church at Evanston, Ill., are shown. This church had been covered previously with hand stucco which did not hold. Fig. 5 shows the appearance of the brick walls before the gunite coating was applied.

In order to remove the last of the old stucco and prepare the wall for the gunite coating, pneumatic bush hammers were used over the entire surface. The

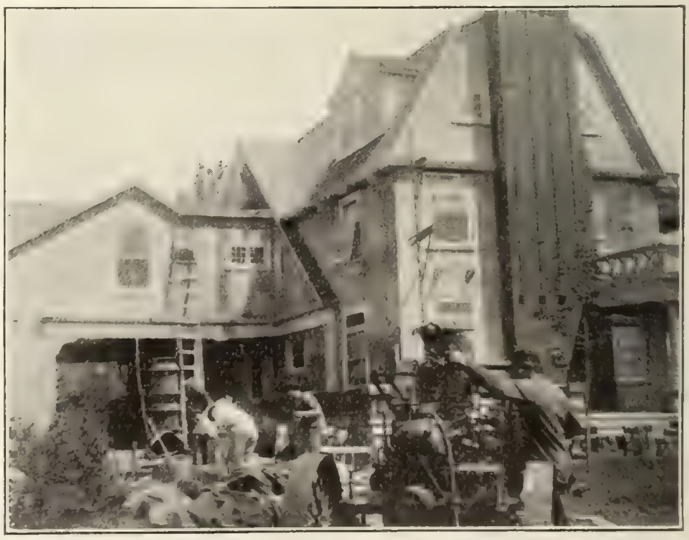


Fig. 7. -Showing how Gunite is applied to frame houses.

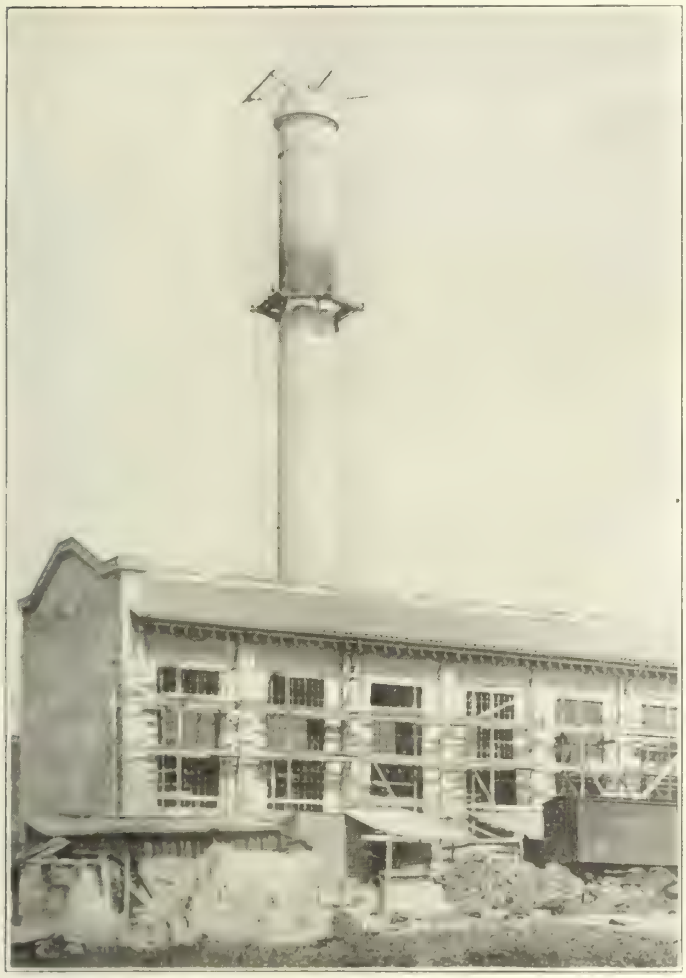


Fig. 8. Reinforced concrete power house with Gunite coating.

materials for the gunite were limestone screenings and Portland cement mixed in the proportion of three-to-one. The thickness of the coating was about ¾-in. The limestone sills and trimmings of the church were also badly disintegrated and brought again to true lines, as shown in Fig. 6, which gives a partial view of the completed work. Numerous other brick buildings have been treated in a similar manner in all parts of the United States and elsewhere, among them being some very large warehouses at the New York docks.

Figure 7 illustrates how gunite is applied to frame houses. Hundreds of such buildings have been successfully coated and at a cost which allows most extensive use of the cement gun for this purpose. The house is at once made cooler in the hot summer days, and the cost of heating the house during the winter months is greatly reduced. The gunite coat reduces the fire risk and, being practically indestructible, will prolong the life of the building.

On all work applied to wood the gunite coat is reinforced with a light wire mesh which is nailed against the surface to be covered. The thickness of the coating is usually ¾-in. Any desired finish can be given, and frequently coloring matter is used in the last coat to good advantage. All parts of the building which are not to be coated, such as windows, cornices, etc., must be protected with tar paper, cloth or the like for the reason that it is difficult to remove unavoidable cement splashes. Fig. 8 shows a large reinforced concrete power house with chimney, the surfaces of which have been covered with a thin gunite coating to conceal the form marks and to produce a uniform finish for the entire structure. In this same view is a chimney 150 ft. high. The finish was applied with the gun standing at the ground level and the material was shot to the top without any inconvenience. This illustrates the carrying power of the cement gun and the adaptability and advantage of the machine for work difficult to approach. Only a very thin coat is usually required to cover the form marks and the bond is perfect without the employment of any artificial means. The gunite finish forms an integral part of the entire structure and at the same time waterproofs it effectively. It is conveniently applied to all surfaces as walls, floors, ceilings and roofs. For coating expanded metal and rib metal the cement gun provides an economical method. The cost of forms and scaffolds can be almost entirely eliminated on most of such work. The cement gun has been used for the construction of thin partition walls and hollow walls for buildings. For such work no forms are required except a light frame covered with building paper to hold the reinforcement in place and to act as a temporary backing. This framework is usually made of 2 in. by 4 in. uprights, spaced about 18 in. centre to centre. After the gunite has set, the frame may be removed and another finishing coat applied to the back, or the frame can be left in place. Often both sides of the frame are covered alike and a cheap and strong hollow wall is the result. A number of residence buildings have been erected where practically all cement work was done in this manner with the cement gun at a saving of cost over other construction which might have been employed. Figs. 9 and 10 show the gun work done on the new warehouse for the Illinois Steel Warehouse Company at St. Paul, Minn. The building is a steel and concrete skeleton structure and all the curtain walls between the frame work have been built by cement guns. These curtain walls are 2 in. thick and reinforced with No. 6A triangular wire mesh. A light wooden form was used on the inside as backing and to hold the wire mesh in place. The convenience with which the work was done is illustrated in Fig. 9, which shows the workmen standing on the hanging scaffolds. Two guns were in operation in order to finish the work in the shortest possible time to avoid the winter season. Fig. 10 shows a finished portion of the building.

Gunite has been used for the waterproofing of reservoirs, canals, aqueducts, bridges, basements, etc. The most important point in connection with such work is the fact that no ingredients or compounds are used which are foreign to concrete or which may gradually

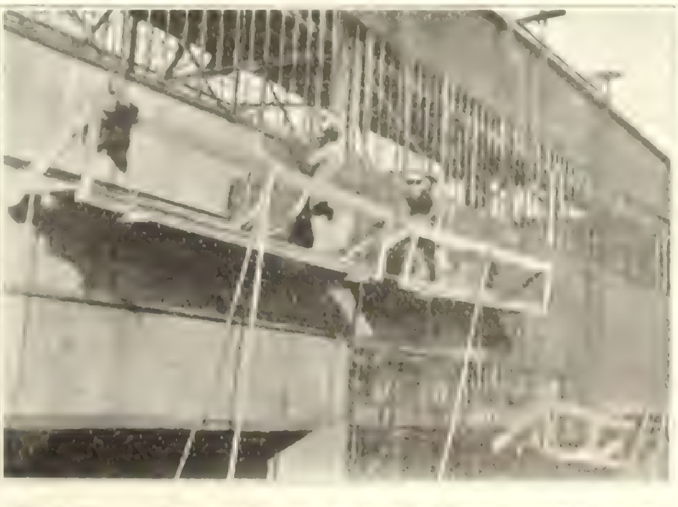


Fig. 9. Showing gun work on new warehouse for Illinois Steel Warehouse Company, St. Paul.

deteriorate. Gunite consists of cement and sand only and is waterproof on account of its characteristic density. Fig. 11 shows the Twin Peak Reservoir at San Francisco. One-half of it is filled with water, while the other half, being perfectly dry, was used as a temporary auditorium. This reservoir is 370 feet long, 285 feet wide, and 27 feet deep, and when filled it holds 11,000,000 gallons. The partition wall is 1 ft. thick and is supported by buttresses placed 8 ft. apart on both sides. When the reservoir was first filled, it was found that in spite of all precautions taken, considerable water found its way through the wall, and therefore it was finally decided to use the cement gun for the purpose of waterproofing it. A coat of gunite only ¼ in. thick at the top and increasing to ½ in. at the bottom was applied on both sides of the partition wall and the buttresses. Immediately after the gun work was finished one-half of the reservoir was filled, with the result as shown.

Another large reservoir waterproofed with gunite is the water reservoir of the city of Nashville, Tenn. The work is shown in Fig. 3. The stone walls are 36 feet high. The reservoir is round, 463 ft. in diameter, and with a dividing wall as shown. This reservoir broke on account of seepage and had to be partially rebuilt. The inside and partition were waterproofed with gunite. This was also applied over the surface averaging 1½ in. in thickness, following the contours of the rough stone wall. The bottom was sealed with a concrete floor.

Another field which the cement gun has entered is the repair of such stone, brick, steel, and concrete structures as have developed weakness and have deteriorated under the influence of loads, water, and atmospheric conditions. In Fig. 4 we have already seen how this work is done.

Fig. 10.—Another view of St. Paul warehouse.

(Concluded in next issue)

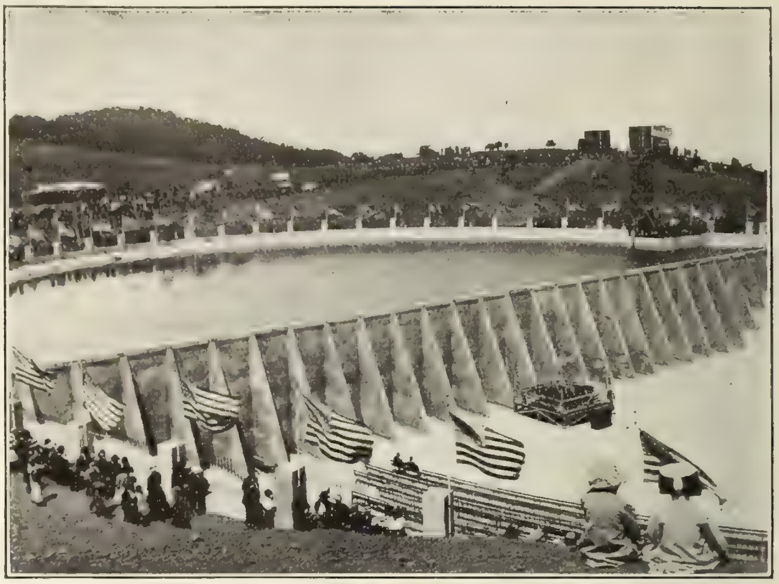


Fig. 11.—Twin Peak Reservoir at San Francisco.

A contract calling for 9,800 ft. of 36-in. flexible-jointed cast-iron pipe has been let in connection with New York City's Catskill water supply. The pipe is to be used in forming a siphon under the Narrows, the strait between Staten Island and Long Island, connecting the upper and lower bays. The submarine pipe line will carry the water supply brought from the Catskill aqueduct to Staten Island. On account of the traffic in and out of the port of New York the laying of the pipe, which aggregates 3,600 tons, involves unusual difficulties.

A Warehouse with Girderless Floors

A warehouse 100 x 271 feet, ten storeys in height, has just been completed at St. James Avenue and Arlington Street, Boston, for the Paine Furniture Company. The entire construction is of steel columns with concrete fireproofing and reinforced concrete slab floors up to the eighth floor. Above that floor the interior columns are reinforced concrete two feet round. Stiffener angles on the exterior steel columns, at the base of the column caps, support the floors, which are 8-inch slabs with multiple way reinforcement. The reinforcing rods are bent up near the columns to give shear compression to the reinforcement. The excavation began January 4, 1913. About 5,000 spruce piles were driven up to 30 feet deep to hard clay. Two steel derricks were set in the pit, each with 95-foot mast and 85-foot boom, and opposite them two concrete mixers were set up. Footings, basement floor girders and floor slab were concreted by the derricks, ¾-yd. buckets being used. Tar paper and tar pitch waterproofing were used over the footings and the basement floor. An inch of grout was used over the waterproofing, and on this the column bases were set, cast-iron for exterior and 6-inch steel slabs for interior columns. Exterior columns for the first floor were of one-storey height; all other columns, exterior and interior, were in two-storey length, breaking joints. Three-eighths-inch spirals wrapped all columns and were tied to four ¾-inch longitudinal rods, as bond for the concrete fireproofing. One set of forms for a complete floor with shoring frames was prepared. The column-head forms were made in two pieces, with a 6-foot hole for the cap form, and these were placed in position by the carpenters four or five days ahead of the floor panels (4 x 10 feet). Galvanized column and cap forms were used, the former two feet in diameter. Form work was kept three days in advance of the reinforcing and that three days ahead of the concreting. Floors were stripped about 48 hours after concreting and the same forms were used from the first to the top floor with but little patching. The last four floors were completed in 32 days.

The Control or Prevention of Stream Pollution

By Paul Hansen[*]

IN uninhabited or even rural districts the evil results of stream pollution are practically negligible, but in urban districts streams are rendered exceedingly foul by the enormous quantities of sewage and industrial wastes poured into them from city sewers. These streams become totally unfit for pleasure purposes, the land along the banks is depreciated in value, and public water supplies drawn from the streams may be grossly contaminated and constitute an extreme danger to public health. An enormous toll in human lives is annually exacted as a result of polluted streams, not to mention the economic loss due to depreciation in property values.

To prevent the evils of stream pollution gaining too great headway, central governmental control backed by an intelligent public opinion is essential. The molding of an intelligent public opinion is, however, a rather difficult matter, for even among persons who have given considerable thought to sanitary subjects, there exists gross misconceptions as to the logical and practicable way to treat the problem of stream pollution. There has been a tendency to permit sentimentality to get the upper hand, and this has resulted in giving wide currency to some extravagant demands that are wholly impracticable. There is, however, a group of sanitary engineers who have come into intimate contact with actual problems relating to the prevention of stream pollution, and among these engineers there has gradually come about a unanimity of opinion regarding certain essential factors relating to the stream pollution problem. It will be the object of this paper to present these opinions, and the statements made will be largely based upon recent careful inquiries among sanitary engineers and others interested in sanitation.

The subject may best be treated by first considering in a broad way what the functions of a stream really are. Having reached a satisfactory conclusion upon this point, it will be possible to consider certain special uses of streams with respect to stream pollution.

General Functions of Streams

The proper conception of a stream recognizes the dual function of watering and draining the country through which it passes. Some pollution of streams is inevitable; for with increased density of population, increased cultivation of the soil and increased numbers of urban communities, it is practically impossible to prevent the discharge of all deleterious matter into streams. It is only reasonable to require that the pollution of streams be maintained at less than a certain fixed maximum, and this permissible maximum pollution vary according to the character of the stream, the population along the banks of the stream and the uses to which the waters of the stream are placed.

Streams Used as Sources of Public Water Supplies

Since streams in the ordinary course of events must receive more or less contamination, it follows that public water supplies drawn from surface streams must of necessity be polluted, and should not be delivered to the consumers unless the water is first adequately purified. One exception may be made to this general rule, namely, in the case of water supplies derived from streams draining comparatively small watersheds. In such cases it is sometimes feasible for the water supply authorities to own the entire watershed and control it in such manner as to make contamination of the water courses impossible. But in general we have this question to contend with: How much pollution may be permitted to enter a stream before the water thereof is polluted to a point beyond redemption by water purification methods? This is a question that taxes the greatest ingenuity of sanitary experts, and it is always necessary for any specific problem to be considered on its particular merits in order to obtain what is the best and most economical solution.

Notwithstanding the great difficulty in defining that degree of pollution which is permissible in streams which are to be used as public water supplies after purification, there would seem to be an advantage in attempting to approximate a general rule for the control of such streams. A rule has been formulated in the light of the present available evidence, but it must be admitted that this rule is not based upon any very scientific data and it can, therefore, only be put forward tentatively, with the expectation that it will be modified from time to time as more and more experience is acquired. This rule may be stated as follows:

The time in hours required for the passage of a particle of water from a sewer outlet to the point of waterworks intake during high water multiplied by the dilution available during low water in cubic feet per second per 1,000 persons tributary to the sewers should equal a constant and this constant should not equal less than forty. This may be expressed mathematically as follows:

$$T + D = C.$$

In which T = time in hours required for the passage of a particle of water from the sewer outlet to the waterworks intake at high water;

D= dilution available during low water in cubic feet per second per 1,000 persons tributary to the sewers; and

C= constant which it is recommended be not less than 40.

The above formula applies to streams in which there is no appreciable increase in volume of flow between the sewer outlet and the point of water works intake. In the case of streams which receive the discharge of large tributaries between the point of sewer outlet and the point of waterworks intake, the formula must, of course, be modified. Generally it will be merely necessary to assign a value of D, which represents the mean of the quantity of water flowing past the sewer outlet and that flowing past the waterworks intake. If the factor of safety proves to be more than 40, purification of the sewage will not be necessary for the protection of the water supply. If the factor of safety is less than 40, some form of purification will be necessary, and this may vary all the way from plain sedimentation to intermittent sand filtration followed by sterilization.

The formula, of course, is intended to be used merely as a rough guide, and it is conceivable that there are instances where it will not apply. Take, for example, the case of a very large stream, where a sufficiently large factor of safety may be obtained with the sewer outlet at a very short distance above the point of waterworks intake, and on the same side of the stream; here it is manifest, due to the impracticability of securing a mixture of the sewage with the entire volume of the stream, that the sewage must receive treatment or the waterworks intake must be extended to a point above or, at any rate, beyond the influence of the sewer outlet. As a rough guide, however, such a formula may serve a useful purpose in narrowing down the widely divergent practice of the present time.

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[*] Engineer of the State Water Survey of Illinois.

Streams for Recreation Purposes

Of recent years growing importance is attached to the maintenance of our streams for pleasure purposes. Every summer there may be found scattered along the streams within a radius of fifty miles or more of our large cities numerous camps. This form of summer vacation is a comparatively cheap and normally a healthful means of recreation. It ought to be regarded as one of the means of improving the health tone of our urban communities, inasmuch as it is within the means of so great a number of people.

Under this head may be asked how high a degree of purity should be demanded in a stream which is extensively used for recreation purposes, but not for public water supply? Within the last few years much emphasis has properly been placed upon the purification by oxygenation in which a natural resource is utilized instead of an artificially constructed purification works. It has generally been held—and in most instances rightly held—that the degree of dilution necessary is merely that which will prevent a nuisance, having reference primarily to unsightly floating matter and bad odors. For most rivers and many of the smaller streams of the country, this requirement as to the cleanness of the waters is all that is necessary.

There is, however, a certain class of streams which, because of the beauty of the country through which they flow and their specially favorable location, become highly prized for camping and recreation purposes. It is a striking circumstance, in fact, that recreation seekers nearly always look for the stream valleys, which illustrates the craving of man for a combination of land and water, by means of which nature presents her most alluring and most picturesque aspects. These streams, as a rule, have no large cities upon their banks, but merely here and there a small town or village. The sewage from such small towns and villages may not be sufficieent to produce a visible contamination except possibly throughout a very short distance below the sewer outfalls. Such contamination does offend the aesthetic sense, however, and undoubtedly does add some danger to public health, for the reason that, when a stream is used for recreation purposes, it will be used for boating and bathing and as a domestic supply to some extent among campers, though it may not and should not be used for drinking water. It seems to the writer that such streams as these deserve greater protection against contamination than merely to prevent nuisance.

No definite rules to apply to all cases can be laid down, but as a general principle it may be said that if such a stream is not polluted to any material extent by storm water and street wash, such as would obtain in the case of a city of considerable size located upon its banks, it would seem perfectly feasible to purify the sewage to a point where it will give no evidence of its existence even in the vicinity of the outlet. Furthermore, the sewage effluent should be sterilized by the cheap and satisfactory means of using bleaching powder, so as in large measure to guard against dangers to health among vacationists which may result from boating, bathing and domestic uses of the stream other than for drinking.

Fish and Shell Fish

Many streams are valuable to the community on account of their fish life. It may be said, in general, that there is rarely necessity for so polluting a stream as to endanger fish life, though there are some circumstances where the continuance of certain liquid-waste-producing industries injurious to fish is of so great importance to the general welfare that fish life in certain streams must be sacrificed.

The maintenance of fish life does not necessarily imply an unpolluted stream. It is merely necessary that the alkalinity of the water be maintained and that the pollution be not so great as to absorb the dissolved oxygen in the water to an extent that will suffocate the fish. The fact is that a moderate degree of pollution favors fish life, in that it favors the growth of microscopic aquatic organisms which constitute valuable fish food. Certain difficulties have been encountered in the contamination of fish by polluted water which causes the fish to decay rapidly and become unfit for human consumption. The danger of infection of human beings with specific disease through eating fish taken from polluted streams is almost negligible, for the reason that, in this part of the world at any rate, fish are not eaten raw. With shell fish, however, the case is quite different, because they are very frequently eaten raw. It has been a common practice along the coast to float oysters in shallow polluted waters, which causes them to become bloated and appear fat. Such an oyster perhaps makes a more delectable morsel of food, but in it may be lurking the germs of typhoid fever or some other water-borne disease. The problem of protecting the shell fish industry is a very complicated one, and all its intricacies have not been worked out. Here again the services of experts are needed to study each zone of shell fish pollution in the light of diverse local conditions.

Discharge of Manufacturing Wastes Into Streams

Many of our important industries, such as paper mills, woollen mills, dye works, starch factories and tanneries require large volumes of water to carry on their industrial operations, and they also produce large volumes of waste which are capable of undergoing offensive putrefaction. The discharge of these wastes into streams often causes unsightly and malodorous conditions; yet, with the exception of tanneries, these waters do not menace the public health, since they do not contain the specific infections of disease. (Tannery wastes may contain anthrax bacilli). In fact, some of the processes are such that the wastes are quite inimical to the existence of disease germs. In some cases it is practicable to treat the wastes so that offensive conditions in a stream may be in part or wholly relieved, but for certain industries such treatment of the wastes is prohibitively expensive.

Enjoining industries against causing objectionable stream pollution may, and in some instances actually has, necessitated the shutting down of works. It is conceivable, in the case of large industries upon which are dependent a considerable population, that an order to cease stream pollution, which is virtually an order to shut down the works, might result in great hardship without adequate returns accruing from the cleaner conditions of the stream. There may be instances, therefore, where a limited few of the streams of the country may legitimately be turned over to the manufacturing interests. Now that the stream pollution problem has become more acutely an issue and the disadvantages of filthy streams are better understood, it would not seem wise to permit waste-producing industries to be located upon any but very large streams which have an ample volume to dilute the wastes to an inoffensive condition. That is to say, the streams which are now clean should be maintained clean, for the reason that we have an ample number of large streams which can effectually take care of wastes from waste-producing industrial plants for an indefinite period in the future.

Typhoid and Paratyphoid Along the Richelieu River

By Theo. J. Lafreniere*

DURING January and February, outbreaks of typhoid and paratyphoid fever occurred in 10 of the 14 municipalities bordering the Richelieu River. The outbreaks have not been severe, although the number of cases has been rather large, the death rate being low for a paratyphoid epidemic. Several cases of true typhoid and paratyphoid have been reported and checked by the agglutination test, but in two municipalities, the symptoms would indicate severe intestinal troubles only.

Paratyphoid is not a reportable disease in the Province of Quebec, and the Board of Health became aware of the conditions along the Richelieu River, through the examination of the water-supply of Chambly Canton. On February 26, complaints were made, that the carcase of a dead animal had been thrown over the water intake of that town, and the inspection revealed that intestinal troubles were prevalent in the town. Inspectors were immediately sent to the various towns bordering the river, above and below Chambly Canton, and it was discovered that in 8 municipalities there had been numerous cases of typhoid and paratyphoid, since January, 1914. The outbreaks having started one and two months before the inspections were made, and the character of the disease being mild, it has been difficult to obtain exact data on the first cases. However, the information secured, given briefly in the table below, shows clearly that the outbreaks have been caused by the river water.

TYPHOID AND PARATYPHOID IN TOWNS ON THE RICHELIEU RIVER, WITH SOURCES OF WATER-SUPPLY

Town	Population, 1911	Cases of Typhoid	Cases of Paratyphoid	Deaths†	Water Supply	Approx. date first case
[illegible]	5000	14	[illegible]	[illegible]	[illegible]	[illegible] week Dec
[illegible]	1900	....	60		[illegible]	[illegible] week Dec
[illegible]	[illegible]	1	15		[illegible]	4th week Dec
[illegible]	[illegible]	2	20	1	[illegible]	4th week Dec
[illegible]	900	[illegible]	25	1	[illegible]	4th week Dec
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	4th week Dec.
St. Hilaire	1300				[illegible]	
St. Charles	[illegible]	a few	[illegible]		[illegible]	[illegible]
St. Marc	[illegible]	[illegible]	[illegible]		[illegible]	2nd and 3rd week [illegible]
St. Antoine	[illegible]		numerous	...	[illegible]	[illegible]
St. Denis	[illegible]		[illegible]	[illegible]	[illegible]	[illegible] Jan.
[illegible]	[illegible]		[illegible]		[illegible]	
[illegible]	[illegible]	1	[illegible]		[illegible]	
[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]	[illegible]

[illegible] supplies with intake in the river. †From typhoid and paratyphoid.

St. Johns and Iberville, where the first cases appeared, are situated on each side of the river, and Rouses' Point, 22 miles above, is the first town on the river. Twelve and 18 miles above St. Johns, there are two small towns having no sewerage systems which are connected with the river by small streams flowing into the Richelieu. No typhoid cases occurred in those towns in December, 1913, and January, 1914. One of Iberville's sewer outlets is a very short distance below St. John's water intake, on the other side of the river, and it is possible that frazil ice which forms above the rapids immediately below St. Johns might have caused the sewage from Iberville to flow on the St. Johns side and contaminate the water intake.

During the first week of March, all the municipalities were notified that the water should be boiled, and five towns have already installed temporary plants to treat the water with chloride of lime. The epidemic is now (March 30) under control, and at its next meeting the Board of Health will decide what measures should be taken to prevent similar outbreaks in the future. It is expected that rapid filtration will be required for the largest water-supplies, and chlorination for the others. Paratyphoid will probably be added to the list of reportable diseases.

The water of the Richelieu River has been analyzed repeatedly since 1909, and the results sent to most of the municipalities. The river is contaminated by the sewage of the bordering towns, and above St. Johns, B. Coli is present in 1 c.c. The bacterial count, however, is relatively low.

The powers granted to the Board by the Quebec Public Health Act, of 1900, are not retroactive, and it is necessary to proceed under the general clause for nuisances, which is rather general, to force the older towns to improve their water-supplies. However, no trouble is anticipated from the towns on the Richelieu River.—Engineering News.

One of the simplest hard cements is the well known mixture of litharge and glycerin made to a stiff paste. It sets hard as a rock and is oil proof. A solution of water glass mixed with powdered calcium carbonate serves the same purpose. A mixture of boiled linseed oil and fire clay resists acid better than most cements, though sulphur melted with glass powder is also ranked as very resistant to chemicals in general. A good stone cement is made by mixing two parts of magnesium oxide, one part of magnesium chloride, powdered stone to suit as filler and water to make a stiff paste. Base magnesium chloride is formed [illegible] American.

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*The author, Mr. Lafreniere, [illegible] Sanitary Engineer to the Board of Health of the Province of Quebec.

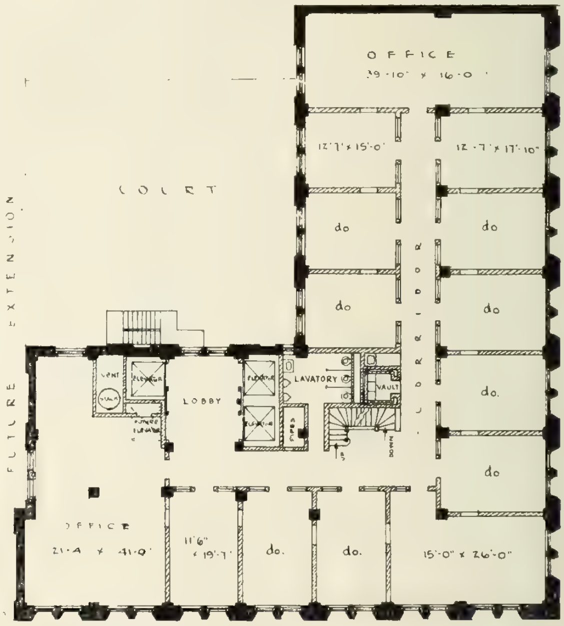
Constructional Features of the Herald Building at Calgary

(Contributed by the Calgary Correspondent of the Contract Record)

PROBABLY the most notable structure erected in Calgary during the past year is the ten-storey office building completed recently for the Herald Publishing Company, one of the properties of the Southam Estate. In its architectural beauty and excellent planning the building is particularly notable, besides being the tallest office building between Winnipeg and Vancouver, as well as one of the tallest reinforced concrete structures in the Dominion. The building occupies a site on the corner of First Street West and Seventh Avenue, diagonally opposite the store of the Hudson's Bay Company. As land values are already very high at this point and are steadily increasing, an effort has been made to gain more than the ordinary amount of rentable area without sacrificing the essential conveniences of the modern office building. The plot of ground is 100 ft. by 130 ft. and of this area the present structure covers a plot 100 ft. by 92 ft. only. The three lower floors cover the entire area built upon, but above the third floor the building is L-shaped, providing a light well 50 feet by 60 feet for the future addition, 28 ft. by 100 ft., necessary to utilize the total area of the lot. The owners have occupied portions of the basement and three lower floors for the publication of their daily newspaper, and in addition there are two stores on the ground floor and 22 offices on the second and third floors. There are seventeen offices on each of the upper seven floors, making a total of 141 offices for rent. In the event of so great an increase in land values as to render the land tax on the publication of their newspaper prohibitive, the owners anticipate vacating the building for publishing purposes, and to this end the beams and floors are so arranged in the ground floor as to permit alteration for a minimum cost.

The Herald Building, Calgary.

The construction throughout is of reinforced concrete, except certain beams and floors in the lower storeys, and the exterior walls are of brick. The street elevations are designed in the style of English Gothic, modified to suit the type of building, the masses being faced with a light brown tapestry brick, with terra cotta details and trimmings in buff. The rear and light court walls are all faced with white hollow brick. All exterior walls are backed with 8 inches of common brick. The top of the parapet is 132 feet above the street grade and there are a penthouse and observation tower rising another 25 feet above the parapet. The total height from footings to top of tower is 172 feet. The reinforced concrete design was made by the Corrugated Bar Company, of St. Louis, who supplied the steel. In general the columns are spaced 12 ft. by 13 ft., there being a total of 48 columns in the typical floors. The framing is the beam and girder construction with "Corr-Tyle" floors in part and solid slabs in the balance of the floor system. A total of 4,700 yards of concrete were placed, with 300 tons of reinforcing steel. The aggregate used was an excellently well graded river gravel. The contractors, in placing this amount of concrete, used a one-cubic-yard Smith mixer, discharging into an Insley hoisting bucket, thence into an Insley hopper, whence it was carted to the forms in wheelbarrows, the maximum distance being about 90 feet.



Typical office floor plan, Herald Building, Calgary.

The Herald Publishing Company occupy about 16,000 square feet of floor space in the three lower floors and the basement. In order to accommodate the press in the basement, it has been necessary to raise the level of the ground floor over an area of about half the building, and so as to change the floor level to the street level, if necessary, the whole of this floor is carried on steel beams, with laminated wooden floors, supported on brackets on the columns. The press is the largest in Western Canada, and has a capacity of 30,000 32-page papers an hour. The mailing department is also in the basement and is served from the press by a conveyor. The editorial offices are on the second floor, together with private branch telephone exchange, telegraph office, library, and lavatories. The composing room is situated on the third floor, where, in addition to the linotypes, are a rolling machine, three pneumatic steam tables, double pump metal pot with two casting boxes, and a plate finishing machine capable of handling six plates a minute. Copy is carried from the editorial rooms to the composing rooms by pneumatic tubes, and the finished plates are carried to the pressroom by a hydraulic lift. On the ground floor there are two stores, one of 2,500 sq. ft., and another of 800 sq. ft. On each of the typical floors there are seventeen offices, aggregating 4,200 sq. ft., or 67½ per cent. of the total floor area, 6,200 sq. ft. There is a total of 80,000 sq. ft. in the building, including basement and sidewalk vaults, of which some 65,000 sq. ft. are revenue-producing, practically 80 per cent. Three elevators serve the building, which is in the proportion of one car to each 25,000 sq. ft. The entrance lobby and elevator lobbies are finished in marble, while the corridors have 6-foot cream terra cotta wainscotting, with plaster walls above. The floors of all corridors and lobbies are terrazzo, while the office floors are maple. The interior trim is white oak. On each floor there is a toilet, a vault with private safety deposit boxes and a mail chute. Each office is supplied with hot and cold water, filtered drinking water, and there are outlets also for gas and for compressed air for the use of physicians and dentists, besides outlets for the vacuum-cleaning system.

The building is heated by a Webster modulating low pressure steam heating system, supplied by two 125 h.p. return tubular boilers, gas-fired, with two Burnham boiler feed pumps cross-connected to one cast iron receiver, and two Burnham vacuum pumps. The premises of the owners are mechanically ventilated, requiring an air washer with a capacity of 15,000 cu. ft., with centrifugal pump driven by a 3 h.p. motor, and with one 54-inch intake fan, and one 42-inch exhaust fan, manufactured by the American Blower Company. The press room is ventilated by one 36-inch disk fan. The water filter is a 50-inch Roberts filter, having a capacity of 3,300 gallons an hour. The vacuum-cleaning system was installed by the Tuec Company, Limited, and has one 4-inch main. The elevators have cars 6 ft. square, with a normal express speed of 550 ft. a minute, and are electrically-driven, Otis Fensom elevators. One machine runs to the basement and two run to the observation tower. Provision has been made for installing a fourth car in this battery, in case the building is enlarged as outlined above, by removable slabs over the shaft. The large amount of power required has necessitated a transformer station in the basement. A high pressure fire system using a Fairbanks-Morse motor-driven pump, with automatic control, and a working pressure of 90 lbs. per sq. in., has also been installed.

The general contractors were Fyshe, McNeill, Martin, Trainer, Limited, of Calgary. Other contracts were as follows: Plumbing, heating, and ventilating—H. Kelly & Company, Limited, Calgary; electrical work—L. K. Comstock & Company, Limited, Toronto and Calgary; plastering—J. A. H. Lake Estate, Calgary; ornamental iron—Alberta Onamental Iron Works, Limited, Redcliffe, Alta.; interior woodwork—Emil Carlson, Minneapolis; sheet metal work and roofing—D. R. Foulds, Limited, Calgary; hollow metal windows—A. B. Ormsby, Limited, Toronto; floors and marble work—Flesher Marble & Tile Company, Limited, Calgary. The architects were Messrs. David R. Brown & Hugh Vallance, Montreal, for whom Mr. A. E. H. Herschel is the Calgary representative.

Methods and Costs of Encasing Steel Structures in Concrete to Prevent Corrosion

TWO methods of encasing steel structures in concrete, namely encasement by pouring and encasement by cement guns, are discussed in one of the appendixes of the report of the Committee on Steel Structures of the American Railway Engineering Association. The report states:

(1) If the floor is protected by concrete encasement where traffic is heavy and ordinary plank floors rapid-poured in place, the cost will be approximately 25 cents per square foot for an envelope 3 inches thick.

(2) Encasement 3 inches thick placed by cement gun will cost approximately 23 cents per square foot.

Specific samples of concrete encasement work are quoted as follows from W. F. Jordan, manager Grand Central Terminal Improvements, New York Central & Hudson River R. R., and from G. E. Tebbetts, Bridge Engineer, Kansas City Terminal Railway:

Grand Central Terminal

The cement gun is being used at the Grand Central Terminal for fireproofing and protecting a part of the steel structure. The yard is in two storeys, the upper tracks being supported on a steel structure with concrete jack-arches. It was necessary to get the upper tracks in service at an early date, so the fireproofing of the exposed parts of the steel below the pack-arches was not done at the time the floor was built.

The lower parts of the beams, the girders and columns are now being fireproofed with the cement gun, using a minimum thickness of 2 ins.; the average thickness is from 2½ to 3 ins., as in the angles and around the stiffeners there is generally more than the minimum thickness.

The fireproofing is reinforced with a wire mesh, 1½ x 1½ ins. of No. 12 wires; this is attached to ¼-in. rods, which are bent around the steel and fastened to it.

The mixture has generally been 1 to 3, but in cool weather, and where the steel is subject to vibrations from the trains running on it, a 1 to 2 mixture is found to be more economical, as it is not as likely to drop off. It is necessary with this machine to use fine sand, as sand with pebbles in it clogs the hose; all of the sand, therefore, has to be carefully screened.

We find that a cubic foot of 1 to 3 mixture, when weighed in a box of 1 cu. ft. capacity after being moderately shaken down, weighs 93 lbs.; if the mixture is wet and applied with a trowel, after setting it will weigh 127 lbs. to the cubic foot, when shot through a cement gun onto a steel structure and set up, it weighs 144 lbs. per subic foot. From this one gets an idea of the density of the fireproofing made with this apparatus.

In applying the mixture of sand and cement with the cement gun from 20 to 25 per cent. of it is lost. Some bounces off as it strikes the structure, some is shot by the steel in working around the angles and get a smooth surface the mason scrapes off the irregularities, and to get a good surface it is floated.

The labor required to operate one machine is as follows: 1 foreman, 1 operator of the machine, 1 nozzleman, 2 masons for floating, 4 laborers screening, mixing and charging the machines. Carpenters are used when necessary to erect scaffolds.

One of these machines uses compressed air to the amount of 100 ft. of free air per minute at a pressure from 35 to 40 lbs. The hose through which the mixture is conveyed wears out quite rapidly and renewals amount to about $1 per day. We have averaged covering about 500 sq. ft. per day of the thickness mentioned above. This method would appear to give an excellent protection for the steel. The material is very dense and the method of application such that every inch of the structure is uniformly protected. The great thickness used in this work is due to the municipal laws requiring at least 2 ins. of fire protection.

Kansas City Terminals

In the new structures, which the Kansas City Terminal Railway Company is building, the encasement is applied in the majority of cases by use of the cement gun. This machine consists essentially of a hopper into which the cementitious materials, made up of 1 part Portland cement to 3 parts dry screened sand, are placed; a hose connected to the bottom of the hopper, through which the mixture is forced by air pressure; a nozzle at the end of the hose, to which another hose supplying water is attached for hydrating the materials. At the end of the hose is a cylindrical nozzle having an annular ring at its base, to which the hose delivering the water is attached. This water is delivered inside the nozzle in the form of a fine spray, through which the materials from the gun pass. The nozzle is made of brass, and to prevent wear on the nozzle proper a rubber lining is used. This lining can be replaced whenever necessary.

Before adopting the cement gun, the claims of the company selling it were investigated and test panels were encased. The conclusion reached was that if the cost was not too great, it would solve the problem of encasement. Comparative estimates made are shown below:

Encasement by Pouring in Forms.—Encasement to be 3 in. in thickness; mixture to be 1:2:4 concrete; reinforcement, wire mesh and bars.

Stone, 1 cu. yd. at $1.25	$1.25
Unloading 1 cu. yd. at 20 cents	.20
Loss in handling at 5 per cent.	.07
Sand, ½ cu. yd. at 60 cents.	.30
Unloading ½ cu. yd. at 6c.	.03
Loss in handling at 5 per cent.	.02
Cement, 1¾ bbls. at $1.25	2.19
Unloading 1¾ bbls. at 5 cents	.09
Loss in sacks at 5 per cent.	.03
Total	$4.18
1 cu. yd. equal to 108 sq. ft., 3 in. thick.	
Cost of material per sq. ft.	$0.039
Forms, $1.63 B. M. at $0.050	.081
Mixing and placing at $5.40 per cu. yd.	.050
Insurance on payroll at 5 per cent.	.003
	$0.173
Overhead and profit at 8 per cent. + 15 per cent. = 23 per cent.	.040

Cost per sq. ft. of encasement = $0.216.

Encasement per sq. ft.	$0.216
Mesh No. 3 at $0.06	.018
Bars, No. 5, at $0.03	.015
Total cost per sq. ft.	$0.249

Say, 25 cents per square foot.

Encasement by Use of Cement Gun.—Encasement to be 3 ins. in thickness; mixture 1:3 mortar; reinforcement, wire mesh and bars. Average number of square feet covered in a day of 10 hours, 275 sq. ft. Loss due to gun work, 20 per cent. Loss due to handling sand, 30 per cent. Quantity of sand used in placing 275 sq. ft. 3 ins. thick, 4 cu. yds.

Sand, 4 cu. yds. at $0.60		$2.40
Unloading and screening 4 yds. at $2.51		1.00
Cement, 5½ bbls. at $1.25		6.88
Unloading 5½ bbls. at $0.15		.83
Loss in sacks at 5 per cent.		.11
Water, per day		.15
Gasoline for compressor, 12 gals. at $0.15½		1.86
Oil waste and handling per day		.60
		$13.83
1 foreman, 10 hrs., at 37.5 cents		$3.75
1 finisher, 10 hrs., at 35 cents		3.50
1 nozzleman, 10 hrs., at 32.5 cents		3.25
1 gunman, 10 hrs., at 30 cents		3.00
2 laborers, 10 hrs., at 22.5 cents		4.50
1 boy, 10 hrs., at 12½ cents		1.25
		$19.25
Repairs, etc., per day	$2.00	
Scaffolding for 275 sq. ft. at $0.15	4.13	
		6.13
Interest on gun, $3,000 at 5 per cent.	$0.41	
Insurance on payroll at 5 per cent.	.97	
		1.38
Total		$40.59
Overhead and profit 8 per cent and 25 per cent = 33 per cent		13.53
Cost of encasement		$54.12
Cost per sq. ft.		$0.1968
Mesh No. 3, per sq. ft. at $0.06		.018
Bars, No. 5, per sq. ft. at $0.03		.015
		$0.2298

Say, 23 cents per square foot.

A comparison of the above shows a saving of 2 cents per square foot in favor of the gun work over the poured encasement, and it might be stated that since this estimate was made we have received bids on actual work that check very closely with the above.

The steel work to be encased was designed with open holes 11-16 in. in diameter in webs, stiffeners and flanges, so that in placing and attaching the reinforcement there would be ample provision for rigid attachment to the structure. In attaching reinforcement to girder webs and other large surfaces, the bars were placed on small V-shaped iron saddles and wired through the webs to each other. On flanges the rods were run through steel eyebolts attached to the lower flange, the mesh being attached to the bars by wiring. At the junction of the concrete encasement with the floor, which is also of concrete, a splice was provided by use of mesh placed in the floor previously cast, this splice being four inches in width. Fig. 1 shows typical method of attaching reinforcement to girders.

The steel girders were shipped from the shops with a shop coat of linseed oil, which was removed by the use of a caustic soda wash before encasement was started. All rust spots were removed with a wire brush.

Our experience has shown that the 1:3 mixture placed in the gun gives a resulting mortar of approximately 1:2½, this change being due to loss of sand. The sand must be nearly dry, the dryer the better, a mixture of coarse and fine grains giving better results with considerably less loss, than either the coarse or fine alone.

The sand must be screened as particles over ⅛ in. in diameter clog the gun and cause serious delays.

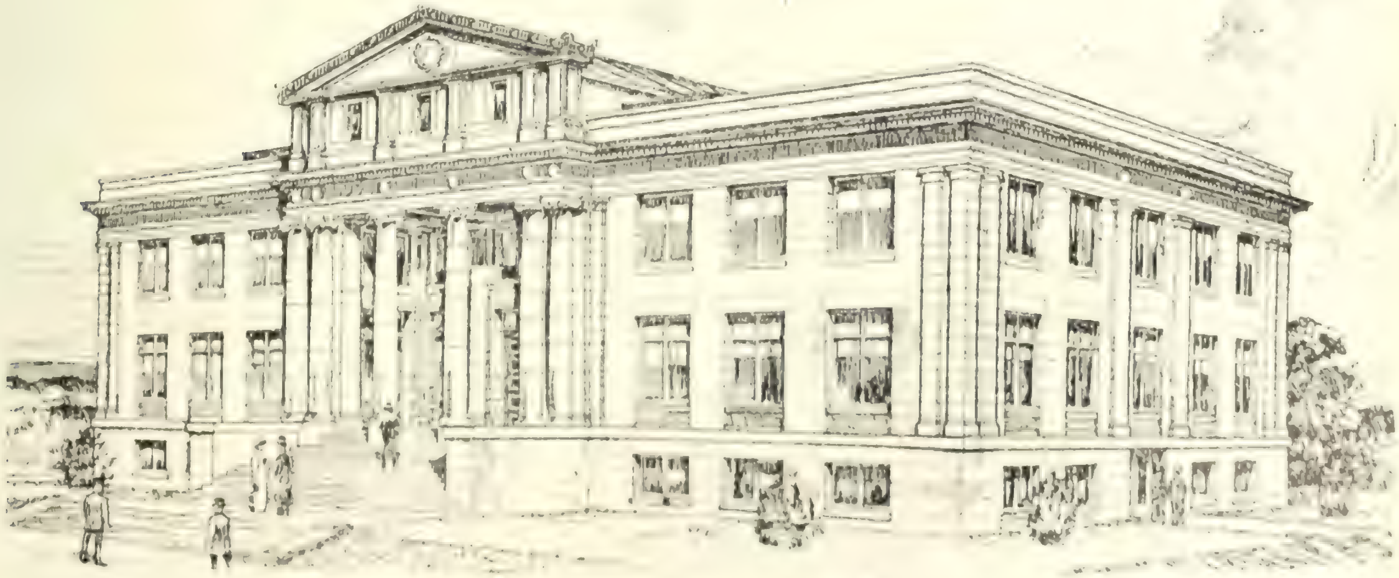
The compressor should be a machine of very ample capacity and an intermediate air storage tank is an advantage.

It was found that it was very difficult to encase the lower flange of a girder, especially so the lower face, and in our work we cast this portion in quite a few cases.

It was also a difficult proposition to get a good, clean job around stiffeners and sidewalk bracket members. On the brackets V-shaped forms were made and used as a backing for the gun work. As to finish, the appearance is fairly good, though far from the smooth, even lines of cast work and a great deal depends upon the finisher as to the final appearance.

The New Courthouse at Vernon, B. C., and Other Structures

Among the number of important constructional undertakings in British Columbia for which the well-known Vancouver and Victoria firm of Thos. Hooper has acted in an architectural capacity is the new Court House at Vernon upon which the work of construction is now rapidly approaching completion. This building, consisting of four floors, occupies a commanding situation at the corner of Mara Avenue, Barnard Avenue and Eighth Street facing west, with the main entrance on Mara Avenue. The treatment followed in the design is Columar Ionic with a dignified main entrance portico paved with marble squares. The construction consists of reinforced concrete for the columns and floors, with exterior facing of local granite, the pitched roof and cresting of pediment being covered with copper. The pedestals at each side of the main entrance steps are surmounted by cast bronze candelabra. The provincial coat of arms has been placed over the main doorway, the doorway itself being of oak suitably carved. Marble wainscotting and terrazzo floors are features of the vestibule and corridors. The interior finish generally is executed in fir. The most outstanding feature of the interior design is the Supreme Court room which measures 50 x 75 feet over the galleries. This apartment has panelled wainscotting to the height of the galleries and is treated with pilasters extending from floor to ceiling, the latter being heavily enriched with plaster work enclosing three large leaded lights. The fittings generally are of oak to the architects' design. Especially designed leadwork has been used in the windows of the staircase, court room and all doors having access from the corridors. The heating is on the Webster Modulating System. In the basement of the building are the coroners' room and sheriffs' office, police headquarters and offices in connection therewith, guard room, cell room, janitor's quarters, storage vault and heating chamber. The main floor is occupied by the offices of the government agent, assessors, commissioners, inspectors and records. The second floor is approached by a wide corridor and the main staircase. Situated on this floor are the Supreme Court room and rooms for the judges, barristers, jury and witnesses, as well as the horticultural hall, a spacious apartment measuring 70 x 32 feet.



New courthouse at Vernon, B. C., now nearing completion. Architect: Mr. Thos. Hooper, Vancouver.

A considerable portion of the space on the third floor is taken up with public galleries extending around three sides of the Court Room. The remainder of this floor has been reserved for future use. Altogether the Vernon Court House may well be described as a structure which in its utilitarian qualities and general architectural treatment admirably fulfills the requirements of a public building of this class.

Another outstanding project for which designs have been prepared by the same firm is the proposed wharf and factory buildings for the Royal Crown Soaps, Limited, which will be situated adjoining the Canadian Pacific Railway tracks on Burrard Inlet above the Second Narrows. Plans for the wharf, which will have a frontage of 125 feet and a depth of 160 feet are now in the hands of the Vancouver Harbor Commissioners for approval. In the construction of the wharf reinforced concrete will be used in the form of slotted piles set in the rock bed of the Inlet and tied back to concrete anchor beams placed in the earth fill. Reinforced concrete panels will be placed between the piles with concrete capping all around the water front. Timber fender piles and waylands will also be placed on the outer edge of the wharf, the centre area of which will be covered with a reinforced concrete slab. A subway will lead from the wharf under the Canadian Pacific Railway tracks to the proposed factory building, and plans of this subway have been submitted to the railway company for approval. The length of the subway is about 100 feet, and the interior dimensions are 10 feet wide by 8 feet in height. It has been designed in accordance with the standard set by the Canadian Pacific Railway for subways of this size with floor and walls of concrete and the roof reinforced with heavy steel. Piles will be driven as required under the footings to secure a solid foundation and the subway will be continued on to the wharf for a distance of 80 feet for shipping purposes.

Designs were recently prepared by the firm of Thos. Hooper for two four-room schools which will be erected in the Fraser Valley, at Sardis and Rosedale, for the Chilliwack Municipal School Board. These schools are duplicate structures arranged to permit of future extensions to double their present size. The interior plan of each building comprises a central stairhall with school rooms opening directly from this hall and also accessible through cloak rooms. The second floor contains teachers' rooms and lavatories, while in the basement are the childrens' playrooms, lavatories and heating chamber. The basement is of concrete and frame construction is used for the superstructure, with shingles for the roofing. Each building has ventilating fleche of wood and sheet metal, and is provided with rear fire escape stairs. The walls and ceilings of the interior are plastered and all interior finish consists of B.C. fir. The fittings throughout are all of the most modern description.

A most successful example of the firm's work in the field of residential architectural is a dwelling recently designed for Mr. Geo. E. Winter in which the style is an adaption of half timber work to Colonial requirements. This house is being erected on an attractive site in West Point Grey where on account of a rapid fall to the north an opportunity has presented itself for laying out the grounds in terraces. The main walls of the building will be of frame construction covered with shingles and concrete will be used for the basement walls. Shingles will also be employed for the roofing. The ground floor contains the living room, dining room and breakfast room, the latter opening to a wide verandah overlooking English Bay. The main entrance is on Second Avenue, with the den, lavatory, stairhall, kitchen and serving hall also on the ground floor. On the second floor are situated five bedrooms two having sleeping porches facing the Bay. The main stairway continues up to the attic floor. The basement is occupied in the rear by the laundry and hot water heating apparatus. Fir is used as interior trim, the hall, staircase and main apartments on the ground floor being fitted with panelled wainscotting of this material. Leadwork in the stairway windows and vestibule doors enhances the appearance of the downstairs portion of the interior. The building is equipped with hardwood floors.

The John ver Mehr Engineering Company, Limited, of London, Eng., and Messrs. Wm. Cowlin & Son of Bristol, Eng., as engineers and contractors respectively, have been awarded the contract for the construction of a duplicate mechanical filtration plant at Toronto Island, the amount of their tender being $1,066,283. Both these firms have offices in Toronto. Four other tenders were received for the work, the highest of which was $1,733,463. The accepted tender provides for brick and concrete buildings, with steel filters. The distinctive feature of the filter proposed is the employment of a gradually moving body of sand as the primary or roughing filtration medium, which eliminates as a continuous process the main impurities from the water prior to its passage through the final filtration medium or stationary sand.

The special Commission recently appointed by the Dominion Government to inquire into the commercial feasibility of the Georgian Bay Canal scheme consists of Lieutenant-Col. R. S. Meighen and Mr. Edward Gohier, of Montreal; and Mr. W. Sandford Evans, ex-Mayor of Winnipeg. The Commission will begin work immediately according to an announcement made by Hon. Robert Rogers, Minister of Public Works. Certain sections of the canal may be taken up and reported upon as to their economic feasibility before the issue of a report upon the whole scheme. The two sections mentioned are one from Montreal for some distance eastward, and the section from the French River to Lake Nipissing.

Plans have been prepared by Messrs. Ohrt and Ouistgood, Danish engineers, for a submarine tunnel nine miles long to connect Denmark and Sweden. The estimated cost is about $25,000,000. The tunnel is to be part of a new railway thirty miles long along the coast of the island Amager, south of Copenhagen. The greatest depth at which the tunnel will run will be about 100 feet, and it is estimated that it will take five years to build. The motive power for traction in the tunnel will be electricity. The tube will be driven through the same kind of stratum, gray chalk, as would a tunnel between England and France.

Standard foundation loads adopted by the bridge department of the National Transcontinental Railway, allow 4 to 6 tons per square foot for clay in thick beds, always dry; on clay, moderately dry, 2 to 4 tons; on gravel and coarse sand, well cemented, 8 to 10 tons; on compact, well-cemented sand, 4 to 6 tons; on clean dry sand, 2 to 4 tons. Average pile loads of from 15 to 20 tons each are permitted. Piles are driven to an average penetration of 1 in. in the last few blows of a 2,000-lb. hammer falling 25 ft. This gives a calculated safe bearing load of 25 tons.

The New Provincial Law Courts at Winnipeg

By R. L. Riggs

THE construction of the new Law Courts at Winnipeg is progressing rapidly. The work was started in the spring of 1912 when the contract was awarded by the provincial government to the National Construction Company, Limited. The building stands on the corner of Kennedy Street and Broadway, and forms one of a government group. It is built of natural Manitoba stone, secured at Tyndal, only a few miles from Winnipeg, and has a basement and three storeys. The construction is of steel, with reinforced concrete floors and terra cotta brick partitions.

There are three entrances, the most imposing one facing on Kennedy Street. This is to have handsome equestrian statues on either side. Heavy columns with Ionic capitals and massive pedestals, mark these entrances, one on Broadway and one at the south-east corner. A dome-capped tower over this corner relieves the square uniformity of the building, which otherwise is broken only by its massive entrances.

Entering the building, one is impressed by the high ceilings and spacious corridors, the latter being finished in marble. The various court-rooms, lecture-rooms and consulting-rooms, are large and airy, being well lighted and ventilated.

The library is on the third floor at the rear end of the building. The Assize Court room also occupies considerable space on this floor. A private telephone exchange and also a fire alarm equipment are provided.

A central power-house is under construction for serving the various government buildings in this vicinity with light, heat and water. An underground tunnel will convey these pipes and cables to the different buildings.

The heating system is forced hot water and the radiators are located in recesses in the walls, screened from view. All the risers are concealed. The temperature is under thermostatic control. The mechanical draft ventilating system will be installed, with the necessary washing and purifying apparatus. The fans are all motor-driven, through silent chain drives. A complete vacuum-cleaning system is provided, with plug outlets at convenient points. The lavatories have fixtures of the modern design.

The electric wiring and conduit system will be of the best modern practice. All piping is installed in the concrete floors. Every room in the building is provided with a side wall flush switch, for controlling the lights. The corridor lights are controlled at the distribution cabinets on each floor, and a master set of control switches is placed in the caretaker's suite. The

Manitoba Provincial Law Courts under construction.

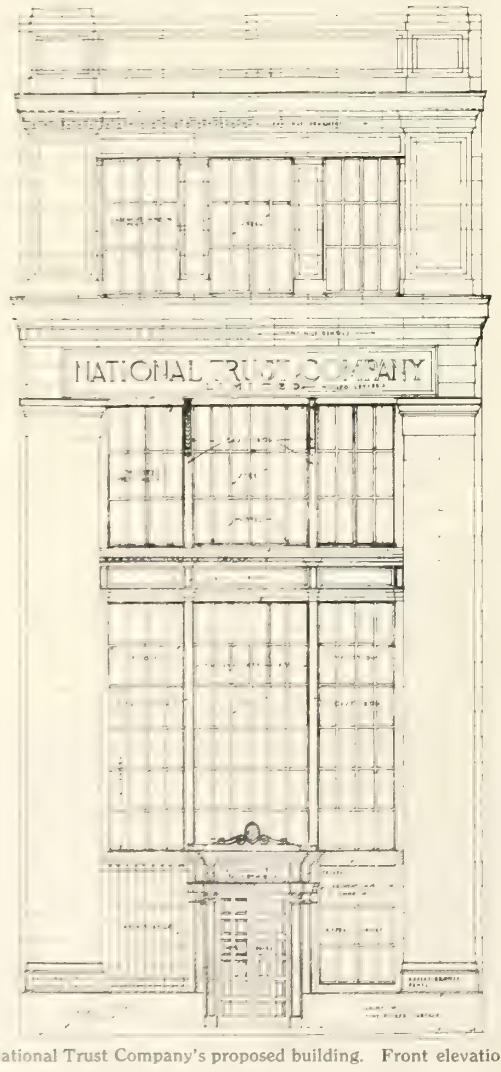
fixtures will be of a finish and design to harmonize with the hardware.

When completed, the new Law Courts at Winnipeg will be one of the handsomest and most modern buildings in Canada.

New Building for National Trust Company, Montreal

Mr. Kenneth G. Rea, F. R. I. B. A., Montreal, has designed a new building for the National Trust Company, Montreal. It will be situated on St. James Street, on a site 21 x 100 ft., and will have foundations and columns of sufficient strength to carry it to the regulation height limit at any future time. The structure will be entirely fireproof, and will have metal windows and wired glass on Fortification Lane. The foundations will be of concrete. The front will be constructed of Argenteuil granite, and the walls wainscotted in Botticello marble to a height of 15 feet, with Caen stone cement plaster above this.

The metal grilles to the elevator enclosures, staircase balustrade, safety deposit vault enclosures, and the office divisions will be bronze plated. The counters and woodwork will be of mahogany. The main entrance from St. James Street will be a very distinctive feature, being intermediate between the basement and main floor, with a handsome marble staircase and balustrade leading up and down. The revolving door enclosure as well as the door itself and the circular sliding doors to shut the building at night, will be of bronze.



National Trust Company's proposed building. Front elevation.

AN APPRECIATION.

A prominent contracting engineer of Western Canada, the author of an article published in a recent issue of the Contract Record, expresses his appreciation of this journal in the following terms:

> "I wish to thank you for the neat manner in which the press work was done and for the attractiveness of the presentation generally. That the article has been read is evidenced by **enquiries received from all parts of Canada** asking where the machinery was obtained and for similar information."

The Contract Record is the recognized medium of the engineering-contracting interests.

The business of the company will be carried on on the main and lower floors, the two upper storeys being rented until required by the company for its own purposes in the future. The safety deposit vaults will be situated in the middle part of the lower floor. There is to be electric lighting and steam heating. The building will be completed and ready for occupation by the first of May, 1915. The contract has been awarded to Messrs. Norcross Bros., Montreal.

H. A. Gardner, of the Institute of Industrial Research, Washington, recommends a pigment of 82 to 88 per cent. of red-lead and the remainder litharge, as being highly inhibitive of corrosion, and more acceptable than any other for general painting purposes. The components should be free from nitrate salts and contain less than 0.5 per cent. of total impurities, such as copper, silica, or iron. The red-lead should be bright in colour, and 99.5 per cent. of a lot should pass a 200-mesh screen. Paints made from this mixture will be practically free from hardening in a package for a considerable length of time, and less expensive than 100 per cent. pure red-lead paints. Excellent results have been obtained in painting directly over metals surfaced with mill scale, especially on large structures; but for smaller work the expense of removing it will be justified by the good results obtained.

The problem of building construction in India is discussed in an American consular report, which states that one of the most significant recent developments in connection with the construction of large buildings in India has been the increasing use of reinforced concrete. This material has greatly increased economy in recent construction of buildings in India, and it is said that it is cooler and more sanitary than native material. Building operations in India have hitherto been noted for undue cost and unwieldy construction. Many houses of the customary type fall every year during the heavy rains at the break of the monsoon, a fact clearly pointing to the desirability of reinforced concrete construction.

The contract for a steel-rivetted pressure pipe line for the Sooke Lake waterworks system has been awarded to the Burrard Engineering Company, Vancouver, by the city council of Victoria, B.C. The contract is worth $324,000.

Three Types of Fireproof Building Construction

By Thos. M. Goodrich*

FIREPROOF buildings can be divided into three general types of construction. The first type is the steel frame building, in which structural steel sections are utilized to carry the entire load coming upon them, these sections being fireproofed with concrete or hollow tile. In the floor construction of this type of building reinforced concrete slabs or hollow tile arches may be used. Both of these types of slab construction have given satisfaction. The reinforced concrete slab is most generally recommended because of its greater fire resisting qualities, and because it forms a monolithic fireproofing around the steel frame of the building without any of the joints which occur in hollow tile construction. If the joints of the hollow tile are not absolutely tight there is every likelihood that fire would penetrate through the open joint and serious damage to the structural steel would result. Another point in favor of fireproofing structural steel with concrete is that such construction protects the steel from rust. This type of steel building is the most expensive of the fireproof constructions, but it is used primarily on account of the great speed which may be attained in erection. Because of the excessive cost of same, many owners and architects have been forced to use reinforced concrete, a type of fireproof construction which is much slower to erect than structural steel, usually requiring at least twice the time necessary for the erection of the said structural steel.

Reinforced Concrete Buildings

Another type of fireproof building is that known as reinforced concrete. In this type of construction, beams, girders, columns and slabs are formed of concrete reinforced with various types of patented, deformed bars, cold twisted square rods, or plain round or square rods. It is necessary that a substantial frame be built of wood or metal to contain and support the reinforced concrete columns, girders, beams and slabs until such time as they are so thoroughly set, or hardened, that it is safe to remove the frame structure or forms, as this is generally called. This necessitates a slower process of construction than can be obtained by using a steel frame structure. In reinforced concrete, the columns are of two types, viz., columns reinforced with longitudinal rods tied together at intervals with wire, and columns reinforced with longitudinal rods and spirals, the longitudinal rods being wired to the spirals. The beams are reinforced with rods which act in tension only, and the strength in compression is developed by the concrete above the neutral axis of the beams. Slabs are reinforced concrete, utilizing various types of reinforcement. There are also several types of flat slab construction in which no beams or girders are ordinarily used. In this type of construction it is usually necessary that columns have caps, which are required to give additional support to the slab. Additional steel is placed within these caps extending into the column and radiating from the column into the slabs. There are various arguments favoring the use of reinforced concrete construction, chief of which is that it is considerably cheaper than structural steel construction. One argument against its use is that speed of erection is very much slower than structural steel. Another is that in high buildings, or in low buildings having heavy live floor loads, columns must be built of such great size that too much valuable floor space is wasted.

The System "M" Type

The third type of fireproof construction is that which is known as System "M." This construction is patented by Mr. Guy B. Waite, Consulting Engineer, New York City. System "M" structural steel is used in a manner more economical than that of the ordinary type of steel construction mentioned in the first part of this article. System "M" columns are of several types. Where it is desirable to make them as small as possible, "H" shape or plate and angle columns are used to carry the entire live and dead loads coming on them. Columns erected in this manner can be fireproofed with concrete, hollow tile or other fireproof material. Another type of column used is formed of two channels turned towards each other, these channels being connected with batten plates or lattice bars. These columns, after being erected, are filled with concrete and the same takes its part of the load in conjunction with the structural steel. Another type of column used in System "M" construction is formed of four angles turned toward each other, connected together with batten plates or lattice bars and filled with concrete as mentioned above. Beams and girders used in this construction are a combination of structural steel and concrete, the strength in tension being developed by small steel "I" beams, channels or other structural shapes. These are placed below the neutral axis of the combined concrete and steel beam. The strength in compression is developed by the concrete above the neutral axis of the combined concrete and steel beam. Slabs between beams and girders are of reinforced concrete and various types of bar or mesh reinforcement may be utilized in same. With buildings of System "M" construction the same speed (and often better) can be made in erection as is obtained with the ordinary steel frame type of construction mentioned in the first part of this article. This is possible because less shop work is required in System "M" construction, and there is considerably less tonnage to handle in the field. System "M" buildings twenty storeys high have been erected. In high buildings erected in this type it is possible to make any needed provision for wind bracing. Steel may be erected several storeys ahead of the forms and concrete, the forms being suspended from the structural members. The webs of beams and girders are punched to receive shear bars, which pass through the webs and extend into the slabs. By this means a rigid shear bar connection is obtained with the tension member, which is not the case in the majority of buildings classified under the second part of this article. It is impossible to misplace the structural members of System "M" work, as detailed drawings are made for the various members in the same manner as is required in the ordinary type of steel frame buildings. The connections of the various members to each other are made in the same manner as in the ordinary type of steel frame building mentioned in the first part of this article. As regards the economy of System "M" construction over the usual type of steel frame building, the saving is from 50 per cent to 70 per cent of the tonnage required for beams and girders. If the columns are built of two channels or four angles, a considerable saving is made in the amount of steel entering into the columns. In numerous cases System "M" has competed against reinforced concrete and secured the work on a competitive basis. A building in this type of construction can be built in considerably less time than in reinforced concrete and gives the owner a much better type of fireproof building.

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*Ex-Chief Engineer, Canadian Standard Concrete Steel Company, Winnipeg

Prize Design for Hydraulic Power Station

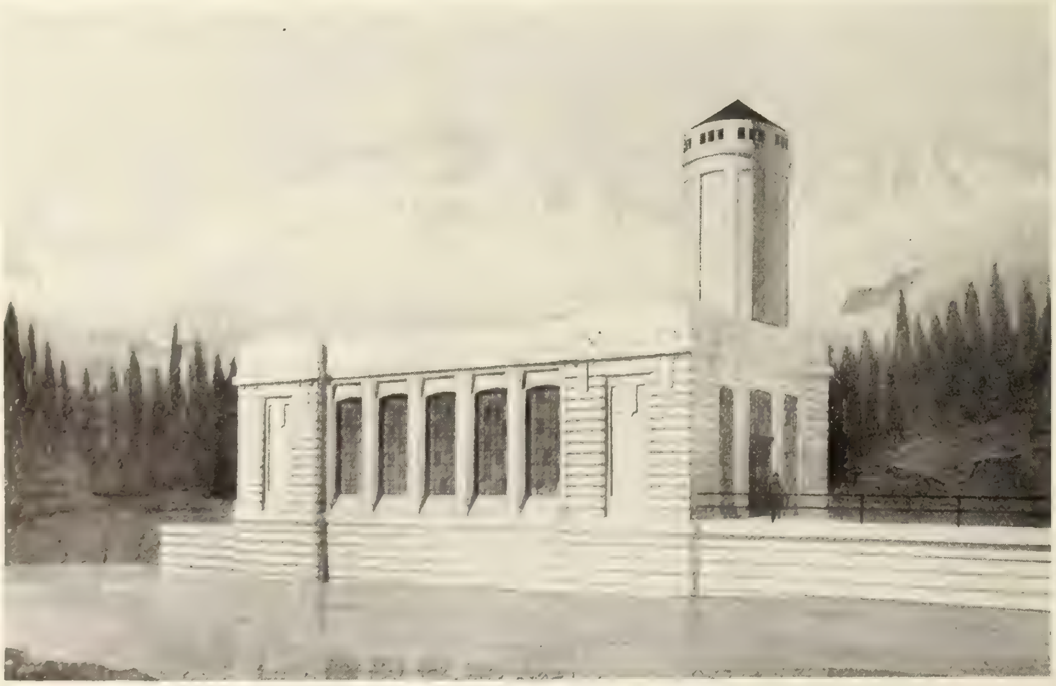
WE reproduce herewith a design submitted by Mr. A. Currie Wilson and awarded first prize in the competition for architectural students of the University of Toronto, in connection with a hydraulic power station on the Cascade River, near Banff, Alta., in the Rocky Mountain Park. The prizes were offered by Mr. C. H. Mitchell, C.E., Consulting Engineer to the Dominion Water Power Branch.

It is understood that the Government will adopt Mr. Wilson's design in the construction of the new building, the dimensions of which will be about 38 ft. by 80 ft. The structure will be built of reinforced concrete or stone. There will be three complete units on 18 ft. centres. Water power is derived from Lake Minnewanka above the site of the proposed power house. By damming the lake at this point the required level is attained. The water is then led through a rock tunnel 600 ft. long to a wooden stave flume line, about 1,800 ft. long, and thence to the water tower shown in the illustration. This tower will take charge of surplus water in the event of the shutting off of the turbine.

Mr. A. Currie Wilson, Toronto

Mr. Wilson is a native of Toronto and entered the Department of Architecture of the University of Toronto with Class '14 in 1910. He has had considerable experience as a draughtsman with architectural and engineering firms and intends to specialize in architectural design.

The ice-breaking car ferry steam-boat, now under construction at Birkenhead, Eng., for the transportation of N. T. R. trains across the St. Lawrence, pending the completion of the Quebec bridge, will be delivered at Quebec in May or June. The principal di-



Prize design for hydraulic power station, near Banff, Alta.

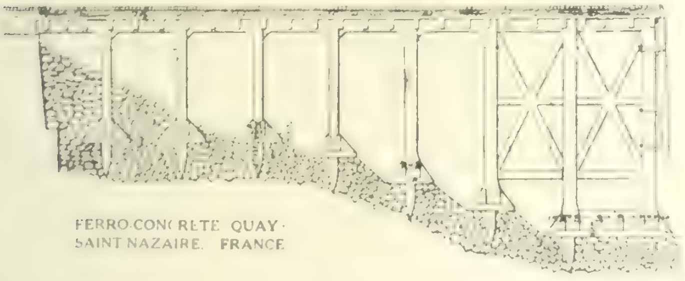
mensions of the ferry are: length, over all, 326 ft.; beam, 55 ft.; with a mean draught of about 55 ft. The propelling machinery will consist of two sets of triple expansion condensing engines, steam being supplied by 8 single-ended, cylindrical boilers working under actual draught. An ice-breaking propeller will be fitted at the forward end driven by a compound condensing engine. The vessel is designed for the conveyance of passenger and freight trains at all seasons. The trains will be carried on a tidal deck arranged above the main deck columns, the latter being stayed by lattice buttresses against longitudinal and transverse trusses.

Novel Type of Foundations

EVERY civil engineer worthy of the name must be able to recall numerous instances of invention begotten by sheer necessity. A case in point is furnished by the recent extension of the quays in the French port of Saint Nazaire.

After the Port Authorities had made an unsuccessful attempt to construct foundations for the extension in the soft mud of the harbour, the problem was submitted for solution to M. Hennebique, of Paris. Owing to the extremely low bearing power of the soil, the foundations were formed of ferro-concrete piles having an extended footing a short distance above the point so as to distribute the load.

As shown by the drawing, the footings rest upon platforms constructed of rock and rough concrete. The footings were first adjusted in position by divers, and the ferro-concrete piles were then driven through a square hole moulded at the centre of each footing. The piles take a secure bearing upon the footings and effectually prevent any transverse movement of the latter. The piles were grouted into the footings after having been driven, thereby rendering the whole perfectly monolithic.


FERRO-CONCRETE QUAY · SAINT NAZAIRE. FRANCE

In order to render the structure additionally secure the front rows of footings were connected by horizontal beams and the front rows of piles by horizontal and diagonal bracing as shown by the drawing. The works were completed several months ago and have given every satisfaction to the Port Authorities.

The quay extension is 1,272 ft. long, and the entire structure was carefully tested after completion under the uniformly distributed superload of 4 metric tons per square metre.—Ferro-Concrete.

A project is before the St. Petersburg Town Council for the establishment of a municipal brickworks to produce at the beginning about 10,000,000 bricks a year, the production to be increased as required by the erection of fresh works in convenient parts of the town. A similar scheme is on foot for the town of Kieff, to produce 3,000,000 bricks a year, the cost of the works to be about 100,000 roubles ($50,000).

LETTERS

The Cause of Several Dam Failures

Editor Contract Record:

I note in your issue of April 15 an article concerning the possible cause of failure of dams. The writer believes this to be a very important paper and is pretty strong in the opinion that several of the most notable dam failures in the country have been due to rock sliding on itself by reason of clay seams in the natural horizontal stratification, where the designer, assuming the bearing power of the rock to be perfectly safe, failed to go down a sufficient depth to provide a barrier, or bulkhead, against the downstream toe which would prevent sliding.

This is discussed fully in a paper by the writer presented to the Engineers' Club of Philadelphia and published in their Proceedings of January 1st, 1912.

It is quite likely that this was the cause of the failure of the dam at Austin, Texas, although that was not given as the theory in the discussion by engineers at that time, but that dam certainly failed by sliding, and the coefficient of friction of the masonry on the rock with the irregularities of the surface would hardly be low enough to account for the failure. Upward pressure can readily be eliminated by making the connection between the base of the dam and the rock previous to water by drainage, only providing a water-tight section under the upstream toe, as outlined in the writer's paper above referred to.

Yours truly,

J. W. Ledoux.

Personal Mention

Mr. Thomas Allison, Toronto, has been appointed Road Superintendent for Wentworth at a salary of $1,800 a year. He was formerly road foreman at Galt.

Mr. Morris Foster, who is well known in building and contracting circles in Toronto, died on April 18 in his seventy-eighth year, following an attack of pneumonia.

Mr. Alexander Watson, Sr., who for almost forty years was in the foundry business in Woodstock, passed away in Toronto a few days ago in his eighty-fourth year.

Mr. F. G. Adams, division freight agent of the Grand Trunk Pacific at Edmonton, has been selected to fill the position at Winnipeg, rendered vacant by the death of Mr. W. J. Hunter.

Mr. F. W. Cowie, Chief Engineer of the Montreal Harbor Board, has been awarded the Telford Gold Medal of the Institute of Civil Engineers, for his paper, "Transportation Problems in Canada, and the Montreal Harbor," read on April 7, 1914. Mr. Cowie's paper was an elaborate review of the history of navigation on the St. Lawrence and the Great Lakes.

Sir William Whyte, who was formerly a Vice-President of the Canadian Pacific Railway, died on April 14 at the Hotel del Coronado, Coronado Beach, Cal. Sir William had resided in Western Canada for more than a quarter of a century, during which period he was in the service of the Canadian Pacific Railway, coming to Winnipeg as General Manager. Eventually he became Vice-President in charge of the western lines and finally assistant to the president. He was born on September 15, 1843, at Charlestown, Fifeshire, Scotland.

Technical and Economical Aspects of Road-Building in Quebec*

By Gabriel Henry†

(Conclusion)

The Question of Surfacing

There is a great variety of surfacings. Leaving aside the earth, sand, clay and ordinary gravel roads which are, as previously stated, very convenient in the majority of the rural roads where the traffic is only local and light, the principal surfacings for highways and rural roads are:—Waterbound macadam and waterbound gravel macadam; bituminous macadam, penetration method; bituminous concrete macadam, mixing method; tar macadam, penetration method; concrete tar macadam; cement concrete surfacing, penetration method (Hassam process); cement concrete surfacing, mixing method.

This is a rough classification. Many attempts have been made elsewhere to properly classify and name the road surfacings, but a complete understanding has not yet been arrived at. Of course, the composition of aggregate used with bituminous or tar cement, for instance, in the mixing and penetration methods, varies greatly and sometimes there is little difference between the aggregate used in the two methods. The names of the surfacing are very numerous, depending on some process in the execution of the work and on the nature of the cement and aggregate used.

Apart from the above surfacing some chemical products, such as rocmac, are found on the market, the function of these being to bind or help to bind stone in the macadam.

Tar, bitumen oils and other chemical or residual products such as calcium chloride and glutin should also be mentioned. Their functions are to protect the road surfacings against the wheels of vehicles, to give them a longer life and to lay dust. These preventives have to be renewed more or less frequently.

The author is merely speaking here of the surfacing and preventives generally used in rural road and highway work and not of the still more expensive paving used in cities.

Now what is to be said in regard to all the above named surfacings? There are such great and important interests concerned in bitumen, tar and cement surfacings, success and failure are in fact so mixed up and the experiments, as reported, have given such widely varying results, that it would be very difficult to give a categorical opinion.

With the economical aspect of the question in view the following conclusions can be drawn:—

There is not at present any surfacing good for general purposes. Automobile traffic requires certain qualities for surfacing, and the narrow steel tires, heavily loaded waggons and motor trucks need others.

All kinds of surfacing can be used with advantage if judiciously and suitably chosen, well laid and maintained.

All surfacings require to be maintained with the greatest care.

A combination of steel tire and of soft tire traffic in different proportions require in each case specially appropriate surfacing.

Bituminous macadam and bituminous concrete macadam, as well as tar, are very suitable for automobile traffic.

Experiments on concrete roads point towards a more general use of concrete surfacing, which does not seem to be affected by a cold climate.

Waterbound macadam, well built, is good for rural roads where automobile traffic is not heavy. Tarring and oiling lengthen its life and allow a medium heavy automobile traffic on it.

All that has been said above presumes that the substructure of the road has been sufficiently drained, that a substantial foundation has been provided for, and that the sum of the thickness of the foundation and of the surfacing are in keeping with the nature and the dryness of the substructure. The road is also supposed to be maintained with care.

In choosing a surfacing the following should be taken into account:—1st, the nature and importance of the traffic both present and future; 2nd, the first cost of the surfacing; 3rd, the probable life of the surfacing; 4th, the cost of its maintenance.

Such information is now easily obtained, and by adding in each case the interest on the first cost, the annual annuity for depreciation fund and the probable annual cost of maintenance of two or more surfacings, the total will indicate the one to be chosen. The first cost should be established as first class.

It may be added here that bituminous and tar surfacing require very great care and experience to be laid properly and that it is more difficult to lay them in this country in a dry climate.

The annual period of work in the Province of Quebec is about one hundred working days; rainy days are frequent as well as variations of temperature, which are at the same time very great.

For a good bituminous and tar surfacing the stone must be dry and not very cold when cement is added. The degree at which the bitumen or tar is to be heated depends to a certain extent on the temperature of the stone and of the atmosphere, and in the autumn the weather is often wet and cold.

With waterbound macadam, as well as other pavings and especially concrete paving, the quality of the stone plays an important role. Soft stone should be avoided as much as possible.

In the Province of Quebec trap and good rock for road purposes are scarce. Field stones are generally employed and the quality varies greatly as they are generally mixed with bad stones. Sandstone of inferior quality is very common; in some districts a kind of bad granite is found, while gravel and quarries with good material for road purposes are rare.

For waterbound macadam, the author advocates the two course macadam:—bottom course, 4 inches loose stones of 2½ inches ring, well rolled with a steam roller of at least 10 tons, no filler; top course, 4 inches loose stones of 2½ inches ring, and appropriate binder entered dry in the course with broom and roller in as great a quantity as possible. The first layer of the binder should be applied before the rolling is begun, and when it is not possible to enter more binder without the roller spraying is resorted to.

The road should be sprinkled until saturated, the sprinkler being followed by the roller. More screenings must be added if needed, and the sweeping, sprinkling and rolling continued until a grout has been formed of the screenings, stone dust and water to fill all voids and form a wave before the wheels of the roller. After that, enough screenings should be spread over the macadam to leave a wearing surface at least three-eighths of an inch thick.

With limestone a course-grained sand, as well as the dust of the crusher, is good, but with granite a limestone binder is generally required. In some districts of the Province only sandstone is available. A limestone binder would be suitable with these stones, but, unfortunately, in these districts no limestone is found, and in such cases the dust from the crusher or the sand is of no value and it is impossible to bind the macadam. Thus the only way to obtain a first bond is to use clay and the traffic does the rest, but for two or three years it is necessary to keep the ruts filled with surface even. Experience shows that it is possible to obtain good results in this way.

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*Paper delivered before The Canadian Society of Civil Engineers in Montreal on April 9.

†Chief Engineer of the Department of Highways for Quebec.

The crown of the macadam is generally three-quarters of an inch for a 16-foot wide surfacing; for a bituminous or tar surfacing half an inch is enough; for concrete one-eight of an inch is suitable.

The choice of a macadam as a surfacing depends not only upon the nature and the importance of the traffic, but also on the quality and the price of the stone. When the stone is of bad quality and dear, it is often more economical to use a more expensive surfacing. In the opinion of the author, the best macadam would be of one sized stone 2½ inches ring, with an ordinary soil, a total thickness of about 9 inches comprising the foundation; also macadam stone should not be mixed with an undue quantity of smaller stones or sand. For a wearing course such a mixture containing too great a proportion of small sized stones and of screenings is not suitable. As a rule it is not uniform, the larger and smaller sizes have a tendency to separate and, if not mixed with care and laid with shovels, the resulting macadam will have a very irregular wearing quality, and ruts and depressions will consequently follow.

In this Province it is very difficult to obtain the one sized stone at a suitable price because few regular quarries sell macadam stone. It is necessary to use transportable crushers, but these give many flat chips which must be utilized. Meanwhile, everything should be done in order to obtain the standard cubical uniformly sized stone.

The preventives mentioned above are serviceable in many cases, but their cost compared with results is rather high and generally have to be applied at least every year. Tarring, however, has given very good results.

The question of the width of the surfacings is not yet completely settled. Meanwhile experience shows that a width of 16 feet is suitable for a provincial road and for less important roads 14 feet is convenient. Shoulders should have a width of at least 4 feet.

Apportioning Work and Costs

Next comes the question of who shall pay for the improvement and the maintenance of roads. Until five or six years ago, in the English townships of this Province, the roads were in charge of the municipalities and were maintained by "statute labor." In the French municipalities the system of shares was almost general.

These two systems were instituted by the settlers in the early days of the colony. Of course, in a vast country, with settlers far distant from one another, it was very difficult to maintain the roads, and each settler took care of his own. In remote colonization districts these systems are still to a certain point rational. They have been transmitted to this generation without any marked modification, have been recognized and regularized by the Municipal Code, and the farmers are still so accustomed to them that it is very difficult to make a change. However, the population and the traffic are growing so quickly that the maintenance of roads is now becoming very difficult and costly, and the old systems no longer meet the situation.

In the States many years ago, statute labor was improved by the collection of taxes instead of work by the municipalities; later, the system of county roads, a far more rational one, was introduced and is now general.

In this Province no county has yet taken charge of its roads, and those called county roads by the Municipal Code are in the charge of the municipalities and are maintained by "shares" or by "statute labor" like by-roads.

Five years ago the Provincial Government passed an Act with the intention of inducing municipalities to abolish "statute labor" and the "shares system," to take care of their own roads, to collect taxes for this purpose and to put the improvement and maintenance of roads under the supervision of a limited number of overseers chosen by the Municipal Council. It is only fair to say that the municipal income is generally trifling, while the mileage of the roads is great, many municipalities having more than 100 miles of bad roads to improve and maintain.

However, since the passing of the Good Roads Act relating to maintenance, some four hundred municipalities, out of eleven hundred in the Province of Quebec, have followed the movement, abolished their "statute labor" or the "shares system" and taken the roads under their charge. Many of the others still cling desparately to the old system in spite of the efforts made by the Government to induce them to abolish it.

A new generation, more favourable to the change, is growing up, and as traffic is increasing at the same time it is to be hoped that in a few years the old system will be a thing of the past. At present the principal object is to direct the movement wisely and prevent extravagances. If this is done and the county road system is then introduced, an economical and effective system will be organized for the improvement and maintenance of rural roads by the municipalities and counties suitable for many years to come.

The advent of automobiles, although an important factor in the question of roads, does not particularly affect the rural roads because automobiles will not for some years increase in such number in rural districts as to cause apprehension to the farmers on account of additional expense in maintenance. It only affects such roads in the sense that automobilists ask for better rural roads; while the difficulty lies in the fact that they desire many highways crossing the country which the farmers contend are not necessary to them and which they will not maintain. Who then is to pay? The improvement of rural roads will benefit the whole country, as well as the farmers, the municipalities and the automobilists. The provincial highways will also benefit the country, the farmers and the automobilists. It thus seem justifiable to divide the cost of improvement and maintenance of the roads of the Province between the three interested parties.

What is to be the proportion for each of them? This is a very intricate question, but one which can be solved. For speedy work, money is not at hand here as elsewhere. The system of long term bonds in the United States came first on the assumption that the next generation would benefit by the improvement as well as the present one. But complaints soon arose. One thing had been overlooked, and that was the difference between permanent work and passing or short lived work.

For permanent work long term bonds can be used. Short lived work constitutes the larger proportion of surfacing. A good bituminous surfacing is said to last from 10 to 15 years with a moderately high traffic in spite of the maintenance. Consequently, for such surfacing only ten year bonds would be advisable. For this kind of surfacing, which on account of its high first cost is chiefly used on highways with an important traffic, long term bonds should be avoided because, in spite of maintenance, long stretches have to be renewed at the same time. A macadam well maintained and without automobile traffic will last a long time, as has been proved by many examples in the old countries, provided the maintenance is complete and effective, the material for macadam being generally at hand and [illegible] easily along the road and put in charge of the work. In such cases longer bonds are to a certain extent reasonable.

The fact should not be overlooked that in this country the roads are covered by snow for a great part of the year and consequently, surfacings last far longer than in southern countries.

In this paper the author has only spoken of the details of construction, more particularly connected with roads and of the more neglected ones, leaving aside those forming part of common engineering practice. Owing to the fact that the question of roads is very intricate and its economical aspect important, it has been deemed more advisable to lay stress chiefly upon the general facts governing this question inasmuch as the road engineer has continually to deal with these in practice.

The attention of engineers the world over is being directed to the programme of the International Congress, which is to be held in San Francisco in 1915. Considerable interest in this meeting has been aroused, as shown by the fact that at the present time enrolments and subscriptions have been received from forty-two countries. Full information concerning the Congress may be obtained on application to the Secretary, Mr. E. J. Dupuy, to whom communications should be addressed at the Foxcroft Building, San Francisco.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The Corbett Contracting Company, Limited, Welland, Ont., have been incorporated with a capital of $100,000. The new company will undertake general contracting.

Mr. Michael Conroy, a St. Catharines contractor, has secured the contract involving 800,000 cubic yards of team work on the new Welland ship canal near St. Catharines, Ont.

It is stated that many residents of Peterborough and Otonabee have protested against the proposal of the City Council to build a sewage disposal plant at the east end of the river.

The Toronto Works Commissioners have been asked by the Board of Control to make a report upon the advisability of increasing the amount of contractors' deposits on tenders for city works.

At Fort William, Ont., operations have been renewed on the Customs House, a three-storey building of reinforced concrete and steel construction, with brick and tile facing, estimated to cost $175,000.

While a bridge gang was engaged tearing down a temporary trestle at English River on the N. T. R. west of Cochrane, Ont., the foreman, Jose Sunstoun, was struck on the head by a falling timber and killed.

The present season will probably see several miles of new pavement laid in Ottawa. The Ottawa Construction Company will shortly start work on the construction of 25,000 sq. yds. of asphalt, at a cost of $61,120. It is also proposed to lay one and a half miles of additional pavement.

The improved programme of construction work for this season has been prepared by the town engineer and submitted to the city council of Outremont, Que. The work, which will cost about $300,000 comprises the installation of a new street lighting system, new sewers, paving and opening of roads.

The registration of all master plumbers under the control of the Medical Health Department has been suggested to the Toronto Board of Health by the licensed plumbers of the domestic, sanitary and heating engineers of Toronto. They also suggest the raising of the license fee from one dollar to $25.00 a year.

A delegation of about one thousand representative Canadians approached the Dominion Government recently on the subject of the proposed Georgian Bay canal scheme. A permanent organization meeting was held in the city hall, and it was decided to furnish all necessary information to the recently appointed Government Commission.

A contract has been awarded by the city of Windsor to the William Hamilton Company, Peterborough, for the supply of all the ornamental standards required for the new street lighting system to be installed in the business section of the city of Windsor. There will be approximately 300 of these standards, each equipped with magnetite arc lamps.

According to present indications the amount of building to be carried out in Toronto this season will eclipse that of any previous year. The total value of permits issued in 1912 was approximately twenty-seven and one-half millions, which constituted a record. This year Mr. Price, Acting City Architect, is of opinion that the total amount will be well over twenty-eight millions.

Artesian wells, which promise to solve the problem of supplying the town of Steelton, Ont., with pure water, have been discovered by an Italian named Augusto Biagini, in the western portion of the town. Two-and-a-half-inch pipes have been sunk to a depth of 78 feet, and are now supplying 350 gallons of water a minute. The town will likely erect a pumping station and standpipe to control the supply.

At Quebec on April 11 the Hon. L. P. Pelletier, Postmaster-General, replying to a delegation of Quebec and Levis citizens who waited on him regarding the establishment of a branch of the Armstrong firm at Lauzon, where a new dry dock is to be constructed, stated that the Government fully recognized the importance of encouraging the shipbuilding industry, and that all Government vessels would in future be built in Canada.

The plans for Toronto Union Station, which it is estimated will cost between twelve and fifteen million dollars to construct, have now been decided on by the Grand Trunk and C. P. R., and will be laid before the Railway Board about May 15, upon approval of which work will proceed immediately. The new station will occupy the entire Esplanade from Yonge Street to Bay Street, with elevated tracks running east and west.

Mr. L. C. Fritch, the newly appointed assistant to the president of the Canadian Northern Railway, was in Montreal inspecting the Canadian Northern terminals, and left for Quebec on a tour of inspection of the C. N. R. eastern terminals. Mr. Fritch is a well known expert on terminals, and did much work in that line with the Illinois Central and Chicago

& Great Western Railways. He was Chief Engineer of the latter road before joining the Canadian Northern at the beginning of April.

The Allan Line has decided to make Quebec a terminus for two of their latest liners pending the deepening of the St. Lawrence between Quebec and Montreal. The necessity for a deeper channel has been strongly advocated, and in view of this the Department of Marine and Fisheries have issued returns showing that from 1851 to the close of the fiscal year 1912-1913, $9,610,260 was expended in dredging and over $6,000,000 in plant, shops and surveys. The number of cu. yds. dredged amounts to 85,160,875.

The Ottawa Water bill finally passed the Dominion Parliament on April 17. While the principle of the Currie-McVeity scheme is retained the measure sanctions any change in the location of the intake pipe, filter beds, reservoir, etc., that the experts may deem desirable, and provides for an increase in the cost of the scheme to the extent of $2,000,000, if necessary. A clause in the bill provides for the city obtaining the supply from Thirty-One Mile Lake in the event of the Board of Health disapproving of the Ottawa River plans.

Sixty-three sets of drawings for the new Government departmental block at Ottawa have been submitted by architects throughout the British Empire. The assessors, Messrs T. E. Calcutt of London, J. H. G. Russell of Winnipeg, and J. O. Marchand, Montreal, have selected the six which in their opinion are the best. The names of the authors are not known, the plans having been dealt with so far only by numbers. Without divulging the names the Department of Public Works will request the designers of the six sets of plans to submit complete working details by September 1. The first choice of the assessors will then be commissioned to prepare working drawings, upon which tenders will be invited, and to supervise the carrying out of the work at a commission of 5 per cent. of the contract price. Each of the five unsuccessful final competitors will be paid $3,000 for his work in elaborating the preliminary design.

WESTERN CANADA

At Calgary, Alta., the ratepayers have approved bylaws to expend $260,000 on pavements and $233,000 on concrete sidewalks, curbs and gutters.

At Weyburn, Sask., a bylaw is to be submitted on May 5 to raise $105,000 for extensions to the sewers and water mains. The Engineer in charge is Mr. Geo. Reed.

Tenders are about to be called for the building of a new church for the parish of St. Barnabas at Victoria, B.C. The architect is Mr. J. Drummond Beatson, of the firm of Jones & Beatson, Victoria.

The Manitoba Gravel & Sand Company, Limited, has been incorporated with a capital stock of $100,000 to carry on a general retail and wholesale gravel and sand business. The headquarters of the company are at Winnipeg.

The Pacific Dredging Company, Vancouver, B.C., have been awarded the contract for harbor improvements at Vancouver, estimated to cost $756,000. The work includes a jetty wall, [illegible] ft. long and a channel [illegible] ft. wide at the mouth of the Fraser River.

Office headquarters of the International Irrigation Congress, which will meet for the first time in Canada next September, have been opened in the Board of Trade Building, Calgary, where the Congress will be held. The secretary is Mr. Arthur Hooper, who is doing everything in his power to make this forthcoming event a success.

Bylaws recently approved by the ratepayers of Regina, Sask., authorize the expenditure of $1,441,000, of which practically two-thirds will be for extension of public utilities including sewage disposal works, generation and distribution of electric energy, storm sewers, street railway and water-works extensions, and the addition of a new wing to the local hospital.

The Works Committee of Fort William City Council have outlined in detail an elaborate programme of street improvements for this season. If their recommendations are sustained by the council, the work will be started almost at once, and will cost in the neighborhood of half a million dollars, to include extensions to paving on some of the principal streets; macadamizing on others, and gravelling the less important ones.

Plans for construction work to be carried out by the Saskatchewan Highways Commission this season were recently before the Commission for consideration. An expenditure of $1,500,000 will be made on roads and bridges. The largest undertaking in regard to the latter is the completion of the high level bridge at Saskatoon, which the Department anticipates will be finished by December 31st of this year. Approximately $100,000 will be expended on small concrete and steel bridges.

The C. P. R. Company are improving their hotel accommodation in many parts of the west. At two of the company's most popular mountain resorts, Banff and Lake Louise, the buildings are being increased to provide four hundred rooms. The big hotel project in hand at Vancouver will provide a building containing seven hundred rooms. It will be sixteen storeys in height, while the roof will be laid out as a garden. The building alone will cost about $2,000,000.

The new building which is in course of erection at Winnipeg for the amalgamated firms of Henry Birks & Sons and the Porte & Markle Jewellery Company, promises to be one of the finest structures in Western Canada. With a frontage of 90 ft. on Portage Avenue and 130 ft. on Smith Street, the building is after style of the Italian Renaissance. Beneath the overhanging cornice is a bronze frieze representing the Queen of Sheba bringing fine gold and precious stones to King Solomon.

The City Council of Victoria, B.C., is taking steps to secure data from cities where bridges of the Bascule type have been built, with a view to the construction of a similar structure in that city. Work on the preparation of preliminary plans and estimates of cost will be commenced at once, this work to be done by Government engineers, the letting of the contracts to be carried out by the city under the supervision of the Government. According to original plans the bridge should be erected by the Government and handed over to the city, but by a new arrangement the task will be carried out by the city, and the Government will retain supervision of the work.

The Victoria, B.C., City Council has approved of the terms of the contract between the city and the Burrard Engineering Company of Vancouver, for the fabrication and laying of the steel rivetted pipe line between Humpback reservoir and the city. The contract will be finally ratified as soon as the company provides the bond guaranteeing completion of the work in accordance with specification. The contract calls for the manufacture of the pipe in the vicinity of Victoria at the rate of 250 lineal feet a day. In the opinion of Mr. Rust, Water Commissioner, the firm should complete the contract in nine months upon the basis of 250 lineal feet a day.

Sir John Wolfe Barry's plans for the proposed bridge across the Second Narrows, Vancouver, are said to be regarded as too expensive by the directors of the Burrard Inlet Tunnel & Bridge Company. It is officially announced that Alderman Woodside and Mr. Ernest [illegible], of Messrs. Cleveland & Cameron, the local engineers who are associated with the British firm, will proceed to England to take up the question of reducing the original specifications in order to effect a substantial saving in the cost of the structure. The board will probably find it necessary to invite fresh tenders for the construction of the bridge, as the lowest combined bid, covering both substructure and superstructure in compliance with the British engineers' plans, figured out at $2,376,531.

Canadian Railroad Development

From an official announcement made a few days ago it would appear that the Lake Erie & Northern Railway will not be in actual operation until towards the end of 1914. The ballasting on the road between Brantford and Galt will not be completed for a couple of months. Work on the Waterford bridge is nearing completion, but the Brantford bridge has yet to be constructed.

The Intercolonial Railway Company are having a survey made by their engineers with the object of collecting the necessary data to divert a section of the road so as to overcome the heavy grade that exists between Amherst and Nappan, N.S. The proposed diversion would probably begin at a point west of Amherst and strike the main line of the Intercolonial near Blair's Lake.

Mr. F. H. Clergue, President of the North Railway Company, which anticipates putting under contract the construction of a branch line from Montreal to join the Transcontinental road, has in hand a project for opening up the territory tributary to the railway as proposed between Montreal and Ottawa, on the James Bay. Mr. Clergue expects that the first section uniting Montreal with the Transcontinental Railway will be completed in about two years.

Sixty steel and wood bridges, ranging from 75 to 125 feet in length, will be required in a distance of eighteen miles on the Central Canada Railway, north of Edmonton, for which the route plans have just been filed with the provincial department of railways for Alberta. The survey shows a road from the main line of the Edmonton, Dunvegan and British Columbia Railway at Round Lake, along the North Hart River to the Peace River Crossing. Numerous other engineering difficulties are presented. Engineers report that at least 50,000 yards of earth will have to be removed from every mile of line on the right of way along the North Hart River. The cost is placed at 50 cents a yard. It is estimated that the construction cost of this stretch of line will be more than $50,000 a mile, or $30,000 a mile more than the bonded obligations of the provincial government. The sliding banks along the tortuous windings of the North Hart River are fully 700 feet above the high water level. The grade drops that distance in the eighteen miles of line before reaching Peace River Crossing, where the railway company will span the Peace River with a steel bridge, costing $400,000. Thence the line will continue to Dunvegan, along the north bank of the Upper Peace River. The Central Canada Railway, upon which it is officially announced, work will begin this season, is to be the connecting line between the Edmonton, Dunvegan and British Columbia, and the Pacific Great Eastern railways.

City Planning Conference at Toronto

An International Conference on City Planning is to be held in Toronto, May 25-27. This will be the first occasion on which a Canadian city has been chosen for such an event and the meeting is looked forward to with much anticipation. H.R.H. the Duke of Connaught, has graciously consented to open the Conference and to give an address.

The scope of the Conference may be guaged by a glance at some of the topics which will form the main themes of discussion. Among these may be cited: The Relative Importance of City Planning as Compared with All Other Functions of City Government, by Andrew Wright Crawford, Editor of the City-Planning Section of the "Public Ledger"; Provision for Future Rapid Transit, by J. V. Davies, Consulting Engineer for the Brooklyn Rapid Transit Company; Rapid Transit and the Auto Bus, by John A. McCollum, Assistant Engineer, Board of Estimate and Apportionment, New York City; Protecting Residential Districts, by Lawrence Veiller, Secretary and Director of the National Housing Association, New York City; A Consideration of the Principles and Procedure of a Canadian Town-Planning Act, a draft of which is now being prepared by a special committee appointed by the Commission of Conservation; and Recreation Facilities in the City Plan, by Henry V. Hubbard, Professor of Landscape Architecture in Harvard University.

Additional features will be a tour of the city and harbour of Toronto, luncheon topics, and an open session for the discussion of subjects to be submitted by members of the Conference.

Improved Road Machinery

From our London office we have received a copy of a catalogue devoted to stone-breaking machinery manufactured by Messrs. Goodwin, Barsby & Company, Leicester, Eng. The greater portion of this booklet is devoted to material describing and illustrating the various types of "Acme" stone breakers. This equipment is well known to all users of road machinery, but in this new and revised list it is offered in a new series while still retaining the long-tested principles which have built up its excellent reputation. In this new series a high standard of fitting is attained for the purpose of giving to the user of the machine facility for effecting renewals in the shortest possible space of time. Further, by the high standard in quality of material, the longest life in these renewals is ensured.

The bearings in this series are machined, carefully lined and bedded into bored seatings and are thus instantly renewed. The jaw faces and side plates are of manganese steel of the first quality, combining both toughness and the hardest wearing surface.

The machinery manufactured by Messrs. Goodwin, Barsby & Company is well and favorably known in Canada. Tar-macadam mixers, drying apparatus, tar boilers and tar spraying machines are only a few additional lines which have been tried in this country and found to meet exacting requirements.

The Gravel, Sand and Crushed Stone Company, Limited, Toronto, incorporated in 1913, have this month completed at their property at Erin, Ont., one of the most up-to-date plants in the country for the up-to-date grading of sand, gravel and crushed stone. The property consists of upwards of 35 acres, situated on the C. P. R., with a siding running the entire length. The company have gone down to a depth of thirty-five feet and the quality of the sand and gravel was maintained as far as the shaft was sunk. The property is 1,100 ft. above Lake Ontario, and it is characteristic of the material that there is an absence of clay, loam and organic matter. The company have practically no stripping to do. At present about twelve to fifteen cars a day are being turned out. Contractors requiring clean, sharp sand, screened gravel and crushed stone are invited to communicate with the firm at 122 William Street, Toronto.

Mr. F. C. T. O'Hara, Deputy Minister of Trade and Commerce, has notified Mayor Frink of St. John, N.B., that he is to give evidence on harbor facilities before the Dominion Royal Commission, an Imperial body which will begin sittings in Canada next August.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherst, N.S.

The plans, etc., for the laying of concrete sidewalks on 4 streets are at the office of the Town Clerk, W. F. Donkin, who will receive tenders until 5 p.m. May 4.

Blenheim, Ont.

The laying of concrete walks is being considered by the Town Council.

Barrie, Ont.

The necessary bylaw having been passed plans have been drawn for the laying of 8 in., 9 in., and 10 in. salt glazed sewer pipe, approximately 1,470 ft., on Charlotte, Berczy and Collier Sts.; approximately 7,250 ft. on Blake, Rodney, St. Vincent and Kempenfeldt Sts.; and approximately 390 ft. on Grove St. The engineer-in-charge is J. S. Macdonell.

Bow Island, Alta.

Plans are being drawn by the town council for the construction of a large supply of gas mains and sewers.

Brampton, Ont.

The town council has under construction certain additions to the sewage disposal plant.

Brooke Twp., Ont.

Tenders will be received by Hugh Kennedy, Alvinston, until May 9th, for the tiling, digging and completion of the Coristine drain.

Calgary, Alta.

The city council has been authorized to construct concrete sidewalks, curbs and gutters, at a total cost of $233,000. Engineer, G. W. Craig.

The city council has been authorized to expend the sum of $260,000 on the laying of pavements.

The city council is about to submit to the ratepayers a bylaw providing for the raising of $63,836 for sewer purposes.

Dauphin, Man.

Tenders will be received by the Clerk, J. A. Gorby, P.O. Box 33, up to noon May 2nd, for ditching for drainage. Plans and specifications are at Dept. of Public Works, Room 15, Parliament Bldgs., Winnipeg, and at the Municipal offices, Dauphin.

Dudswell, Que.

The municipal council has authorized the Sec.-Treas. to purchase a road making machine.

Edmonton, Alta.

The construction of boulevards at a cost of $19,380, bylaw for which was recently passed, will be undertaken by the City Construction Dept., City Hall.

Tenders will be received by the City Commrs., until 5 p.m. May 5th, for the construction of water mains. Specifications at office of the Engineer, A. J. Latornel, Civic Block, Queens Ave.

The City Council has approved extensions to the sewers and watermains in First Ave., Eighth Ave., Sixth St., Glengarry St. and Strathcona Road. Engineer, A. J. Latornel.

Estevan, Sask.

Bylaws providing for the construction of sewers and waterworks, at a cost of $68,000 and $35,000 respectively, have been passed by the ratepayers.

Fernie, B.C.

Tenders for a road roller and rock crusher are invited by the City Engineer, W. Ramsay.

Kamsack, Sask.

Tenders will be received by the Sec.-Treas., A. A. Crawford, until 2 p.m. May 13th, for the following:—(a) labor laying water mains and sewers; (b) power house and filter house; (c) furnishing materials for and erecting water tower; (d) furnishing cast iron water pipes; (e) fire hydrants and valves; (f) furnishing and installing pressure filters; (g) furnishing and installing pumping machinery; (h) furnishing and erecting boilers; (j) furnishing and erecting steam engine; (k) furnishing and erecting generator; (r) labor and material for construction of concrete reservoir; (s) furnishing sewer pipes; (t) construction of concrete walk; (x) labor and material for construction of sewage disposal works. Plans and specifications at the offices of the Engineers, Chipman & Power, Mail Bldg., Toronto, Ont., and 47 Canada Life Bldg., Winnipeg, and at the Town Hall, Kamsack.

Leamington, Ont.

The receiving of tenders for pavement construction is laid over indefinitely on account of certain preliminary street work taking longer than was expected.

Medicine Hat, Alta.

Estimates have been completed for the laying of about 310,000 ft. of concrete sidewalks; provision has also been made in the estimates for a large number of sewers and water mains. Engineer, A. K. Grimmer.

Montreal, Que.

Tenders will be received by the Board of City Commissioners until noon, May 19th, for supplying, building and erecting at the low level pumping station, Montreal, two 18 million gallons, steam driven, high-lift centrifugal pumping engines. Specifications, etc., are at the office of the Superintendent of Waterworks, City Hall

Montreal, Que., Verdun

Surveys have been made and the Engineer, Mr. H. Hadley, Town Hall, Verdun, will receive tenders after May 15, for 1000 ft. pavement on Wellington May St., to Mularky St. in scoria block, 3,000 ft. on Wellington bitulithic sq. blk., 4,200 ft. on Lasalle Rd., Wellington St. to 4th Ave. in asphalt; and 4,100 ft. on Church St., in asphalt.

Montreal, Que. (Lachine)

The City Council is considering the laying of bitulithic and concrete pavements at an estimated cost of $120,000.

Newmarket, Ont.

The municipal council has decided that the watermains be extended on several streets, at a cost of $15,000; new cement sidewalks will also be laid, at an estimated cost of $4,000.

North Battleford, Sask.

Tenders will be received by the City Commrs., up to noon May 4th, for the supply and delivery, freight and duty paid of (d) lead pipe and galvanized iron pipe; (d3) brass goods and curb boxes; (d4) water meters. Further information can be had at the office of the City Engineer, J. B. Stirling.

Ottawa, Ont.

Tenders will be called shortly for trunk sewer construction in Rideau Ward, at an estimated cost of $25,000. City Engineer, Arch. Currie, City Hall.

The expenditure of the sum of $80,000 on extensions to the water mains has been authorized. Most of the work will be done by day labor. The sum of $40,000 has also been appropriated for hydrants and meters, tenders for which will be called shortly.

Prince Albert, Sask.

The bylaw having been passed, surveys have been made for the grading of several streets, at an estimated cost of $13,000.

The following alterations to the pump house are being considered by the City Council. The cost is as specified: steel floors $1,000; 2 filters $10,000; venture meter, 12 in., $1,200; installing 400 meters $6,000; 2 pumps, capacity 2,000 gals. per min., $10,500; alterations $500. Plans and specifications are at the office of the Engineer, Angus Smith, City Hall.

Peterboro, Ont.

Tenders are to be called by the city council in 3 or 4 weeks for the paving of about 15 blocks with asphalt. City Engineer, R. H. Parsons.

Redcliffe, Alta.

Plans are being drawn for the construction of 2 miles of concrete sidewalks.

Regina, Sask.

Plans are in progress for the grading and laying of [illegible] ft. of storm water and domestic sewers. Engineer, F. McArthur.

Additions to the sewage disposal plant are proposed by the Works Dept. [illegible] automatic travelling distributors suitable for a rectangular shaped filter bed will be installed. Plans and specifications are at the office of the Engineer, F. McArthur, who will receive tenders.

Tenders for the construction of a 1,000,000 gal. reservoir will shortly be called by the City Commrs. Plans and specifications are at the office of the Engineer, J. M. Mackay, Supt. of Waterworks.

Senneville, Que.
Tenders addressed to the engineer will be received by the Sec.-Treas., L. J. Boileau, 26 St. James St., until noon May 5th, for the construction of about [illegible] miles bituminous macadam pavement. Plans, etc., are at the office of engineer. Engineer, Geo. B. Moxon, Room 514, Can. Express Bldg., McGill St., Montreal.

Strathroy, Ont.
The laying of granolithic walks is proposed by the town council. Tenders will be called shortly.

St. John, N.B.
Estimates for the supply of cast iron pipe are being prepared by the city council.

Stratford, Ont.
A. B. Manson, the engineer in charge, will receive tenders until May 1st, for the laying of 6,500 sq. yds. brick pavement, concrete base, curbs and gutters and 900 sq. yds. concrete pavement.

Truro, N.S.
The town council proposes to construct concrete pavements and sidewalks at an estimated cost of $5,750. The sum of $8,450 has been appropriated for water main extensions.

The expenditure of $5,150 on sewer extensions has been authorized by the Town Council.

Tillsonburg, Ont.
The laying of cement sidewalks is being considered by the town council.

Toronto, Ont.
The Commissioner of Works has recommended the laying of sidewalks on Dinnick Cres. and Rochester Ave., and bitulithic pavements on Hillcrest Drive and Bracondale Hill Road at a cost of $4,000 and $21,756 respectively.

Tenders will be received by the Board of Control until May 19th, for one or more 24,000,000 gal. centrifugal pumps and engines. Specifications are at the Purchasing Dept., City Hall.

Tenders will be received by the Board of Control until May 12th, for the construction of the East Toronto Drainage System Sec. "A,"; also on 13 streets and 7 lanes.

The Board of Control contemplates widening Kingston Rd., from Queen St. to East City limits. The estimated cost is $220,000.

Toronto, Ont., Lambton Mills
The Lambton Mills Ratepayers Assn. are in favor of the construction of a sewerage system. New sidewalks and extensions to the gas mains are also contemplated.

Tottenham, Ont.
Tenders will be received by the Clerk, S. H. Nolan, until May 8th, for the supply and erection of water tanks, cast iron or steel water mains, hydrants, valves, etc., laying water mains and supplying and erecting pumps and engines and reinforced concrete storage basin. Plans, etc., are at office of Engineers, Messrs. James, Loudon & Hertzberg, 79 Adelaide St. E., Toronto, or with Reeve, A. P. Potter.

Vernon, B.C.
The Health Com. has recommended that the engineers be instructed to prepare and submit plans as soon as possible for the enlargement of the disposal works and for the under-drainage system. The work is to be done in sections. The estimated cost is $90,000. Consulting engineers, Cummins & Agnew.

Winnipeg, Man.
Tenders will be received by the Board of Control until May 2nd, for the construction of a sewer in Inkster Ave., from Lot 85, Block 6, to McGregor St., and a sewer in College Ave., from C. P. R. tracks to McPhillips St. Specifications are at office of the engineer, H. N. Ruttan, 223 James Ave.

The city council has adopted the plans submitted by the engineer, H. N. Ruttan, for the laying of asphalt pavement 25 ft. wide on Portage Ave., from Maryland St. to Raglan Rd. The estimated cost is $70,000.

Weyburn, Sask.
Bylaws providing for extensions to the sewers and water mains and additions to the sewage disposal plant, at a total cost of $120,000, will be submitted to the ratepayers on May 5th.

CONTRACTS AWARDED

Edmonton, Alta.
The following contracts have been awarded by the city council. Paving, Dominion Paving Co., $2.19 per sq. yd., for asphaltic concrete, $2.30 for sheet asphalt, 75 cents per yd. for grading. Concrete walks, F. Healey & Lenhort Constr. Co., 16¾ cents per sq. ft., driveways 21 cents, and grading 80 cents. For grading various streets, T. W. Griffin, 1169 4th St. 25 miles of plank walk and crossings, Whitney & Mongan. Street cleaning apparatus: (1) C. Beals & Co., Columbia and 5th St., 10 wagons, cost $690; (2) Gorman, Glancey & Grindley, Jasper Ave., 1 tractor $360; (3) Canadian Equipment Co., 9th St., 2 squegee flushers, 1 sprinkler $4,217; (4) J. H. Smiley, 1st St., 10-ton gasoline roller $2,900.

London, Ont.
A contract has been awarded by the city council to Foley & Gleeson, Ottawa, for the laying of 8,000 sq. yds. asphaltic concrete, pavement at $2.37 per sq. yd., and 2,740 sq. yds. vitrified brick pavement at $2.63 per sq. yd.

A contract has been awarded by the City Council to the Vulcan Co., Ltd., 84-94 Fullarton street, for the supply of sewer castings at $2.25 per 100 lbs.

Ottawa, Ont.
The city council has awarded to the Ottawa Constr. Co., Ceneral Chmbrs., the contract for the construction of 25,000 sq. yds. pavement and 15,600 lin. ft. concrete gutter on 4 streets.

Sault Ste. Marie, Ont.
A contract has been awarded by the Municipal Council to De Pretro & Bombard for the construction of 1,019 ft. of 15-in. sanitary sewers and 4 manholes.

Toronto, Ont.
The following contracts have been awarded by the York Twp. Council: I. M. Scott, Lambton Mills, Ont., sewers on Kennedy and Barrie Sts., $2,400; W. E. Taylor, 323 Glen Road, sewers on Ravensden St., $1,247.

Winnipeg, Man.
The following contracts have been awarded by the Board of Control: J. W. Astley, Engineer of Constr., City Yards, for sewer in Oxford St., $1,146.70; Dom. Constr. Co., 290 Selkirk Ave., for sewer in Front St., $365.60.

Windsor, Ont.
The following contracts have been awarded to the city council. Thos. Chick & Son, 225 Bruce Ave.; Campbell Ave., 10,000 sq. yds. concrete pavement at $1.33; Gladstone and Douglas Sts., 17,000 sq. yds. concrete pavement at $1.29; Alley St., 16,000 sq. yds. concrete pavement at $1.35. C. W. Caldwell, 135 Ouellette Ave.; Sandwich and Ouellette Aves., 10,400 sq. yds. asphalt block at $2.75; London St., 12,000 sq. yds. concrete at $1.49; and Sandwich St., 3,000 sq. yds. asphalt block $7,250.

Railroads, Bridges and Wharves

Athabasca Landing, Alta.
Plans for the Can. Northern Railway round house have been drawn and work will start as soon as the frost is out of the ground. Supt., J. G. Entwhistle, Edmonton.

Bedford, N.B.
Tenders will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m., May 22nd, for the construction of a wharf of concrete and cribwork construction, 167 ft. long, with a pier head 63 ft. long by 78 ft. wide. Plans, etc., are at the offices of the Dist. Engineers, St. John, Chatham, N.B.; the Postmaster, Holderville and at the Dept., Ottawa. Specifications are also at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Brantford, Ont.
The Lake Erie & Northern Railway has been authorized to construct a bridge over the Western Counties Canal.

Brooke, Ont.
The erection of a railway station at this point is being considered by the Grand Trunk Railway Co.

County of Lanark, Ont.
B. G. Michel, C.E., Carleton Place, Ont., will receive tenders until noon May 1st, for the construction of a steel highway bridge with concrete piers and abutments over Bolton Creek Twp. of Bathurst, and 1 reinforced concrete arch bridge over the Indian River, Twp. of Ramsay.

Calgary, Alta.
The plans for the erection of the Can. Northern Rly. Station are about completed; the work is to start in June.

Hatfield Point, N.B.

Tenders will be received by R. C. Desrochers, Sec., Public Works Department, Ottawa, until 4 p.m., May 22nd, for the construction of a wharf of concrete and cribwork construction, 170 ft. long, with a pierhead 86 ft. long by 80 ft. wide. Plans, etc., at offices of district engineers, St. John, Chatham, N.B., Postmaster, Hatfield Point, and at Department, Ottawa. Specifications also at office of MacLean Laily Reports, Ltd., 220 King St. W., Toronto, Ont.

National Park, Ont.
The location for the Canadian Northern Ontario Railway station at National Park, Twp. Boyd, District of Nipissing, has been approved.

Niagara Falls, Ont.
The Ontario-Niagara Connecting Bridge Co., which is seeking information, proposes to erect a new bridge over the Niagara River. Solicitor, Alex. Fraser, Erie Ave.

Prov. of Nova Scotia
It is understood that five stations will be built on North Mountain branch of railway of the Dominion Atlantic Railway. General manager, P. Gifkins, Kentville, N.S.

Orillia, Ont.
Tenders will be received by Freeman Campbell, Randall, Ont., until May 7th, for the construction of a steel bridge with concrete floors and abutments over Nottawasaga River. Engineer, R. H. Jupp, Orillia. Consulting Engineer, Frank Barber, 57 Adelaide E., Toronto.

Ottawa, Ont.
The expenditure of $120,000 on the construction of a steel bridge on Pretoria Ave., has been authorized. The work is to be proceeded with immediately.

Tenders for the Bank St. Bridge will be called about the beginning of May; estimated cost $50,000. City Engineer, Arch. Currie, City Hall.

Province of Quebec
The Canadian Northern Railway has been authorized to construct bridge over Raunbault Creek, mileage 48 from Hawkesbury.

CONTRACTS AWARDED

Vancouver, B.C.
The contract for the harbor improvements has been awarded by the Public Works Dept., to the Pacific Dredging Co., 734 Granville St., $755,993.

Public Buildings, Churches, Schools, etc.

Berlin, Ont.
Tenders for decorating the interior of St. Peters church are invited by L. Bardon, 64 Foundry St.

Calgary, Alta.
A site on Crescent Heights has been donated to the Baptist Union of Western Canada for the erection of the "McArthur" College, but the building will not be started until next spring owing to the financial stringency.

Duncans, B.C.
Plans for the erection of a public building at a cost of $40,000, are being prepared by the Public Works Department. A. A. Coates, of Coates & Fleet, Winch Bldg., Victoria, is the architect.

Drumbo, Ont.
The erection of a church building at a cost of $2,000, is being considered by the Drumbo Presbyterian Church.

Edmonton, Alta.
The City Council has decided not to erect the isolation hospital this year.

Hensall, Ont.
The erection of a town hall at a cost of $6,000 is being considered by the town council.

Hespeler, Ont.
The town hall plans have been accepted by the town council. Evans & Fulford, Scott and Bennett Blk., Galt, are the architects. Estimated cost $35,000.

Jonquieres, Que.
Tenders for the erection of a post office, at the corner of St. Thomas and St. Dominique Sts., will be received by R. C. Desrochers, Public Works Dept., Ottawa, until 4 p.m. May 11th. Plans, etc., are at the office of Mr. Armand Dupuis, Dist. Engineer, Quebec, Que., Post Office, Jonquieres, and at the Dept., Ottawa. Specifications are also at office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Listowel, Ont.
Plans are being drawn for the erection of a drill hall by the Public Works Dept. John Bamford is the architect; estimated cost $20,000.

Lethbridge, Alta.
The erection of St. Patrick R. C. Church will not be proceeded with this year owing to lack of funds. The basement which is completed is being used for church services.

Medicine Hat, Alta.
The Westminster Presbyterian Church authorities are having plans drawn for the erection of a new church at an estimated cost of $14,000.

Montreal, Que. (Lachine)
The City Council propose to build 3 fire stations at a cost of $45,000.

Montreal, Que., Pt. aux Trembles
Tenders for the erection of a school for the R. C. School Commrs. will not be called until after May 1st. Architect, C. A. Reeves, 58 St. James St., Montreal.

Montreal, Que., Rockfield
Tenders for the erection of a school for the School Commrs. of Coteau St. Pierre, are invited by the Architects, Peden & McLaren, 20 St. Alexis St., Montreal.

Montreal, Que., St. Henry
Fred M. Hoadley, 58 Beaver Hall Hill, invites prices for the heating, ventilating, vacuum cleaning system and temperature regulation, connected with the erection of a church building for the parish of St. Zotique.

New Westminster, B.C.
Plans for the addition to the court house are being revised. Tenders will be called later. Architects, Gardiner & Mercer, Western Trust Block.

Niagara Falls, Ont.
The ratepayers having voted $12,000 to purchase the site, the Dominion Chain Co., Ltd., will erect a $95,000 plant and install $90,000 worth of machinery.

Oshawa, Ont.
The Ontario Printing & Publishing Co., propose to erect a printing office on Simcoe Street S.

Owen Sound, Ont.
It is understood that the Owen Sound Yacht Club are about to erect a club house at a cost of $7,000.

Peterboro, Ont.
Tenders close with the architect, A. W. Holmes, 10 Bloor St. E., Toronto May 6th, for all trades except heating plumbing and steel, for erection of a rectory and basement of the church of the Immaculate Conception. Plans are at office of the architect and St. Peters Cathedral, Peterboro.

Port Stanley, Ont.
The erection of a post office and customs house is being considered by the Public Works Dept.

Red Deer, Alta.
Plans have been drawn for a 2-storey addition to the Sisters of St. Joseph R. C. College.

Regina, Sask.
Tenders are to be called shortly by the Public Works Dept., for the erection of the customs house at the corner of S. Railway and Cornwall Sts.; estimated cost $200,000.

The Hospital Board are considering the construction of an underground tunnel from the hospital to the Nurses' Home. Architects, Reilly, Dawson, Hancock & Reilly, Westmann Chmbrs.

Rossland, B.C.
The erection of a school building of brick construction is being considered by the School Board.

Redcliff, Alta.
The erection of a church on 5th street for the Anglican community will probably be proceeded with this spring. $5,000 of the $8,000 required has been subscribed.

Sandwich, Ont.
The erection of a fire hall is under consideration by the town council.

Stouffville, Ont.
A site for the erection of a post office has been purchased on Main St., by the Public Works Department.

Strathroy, Ont.
The erection of a public library, at a cost of $10,000, is being considered by the town council.

Swift Current, Sask.
The high school bylaw having been defeated, certain rooms in the Central Public School will be used for high school purposes.

St. Catharines, Ont.
Plans for the erection of a Sunday School are being drawn for the Queen St. Baptist Church; estimated cost $12,000

Toronto, Ont.
Tenders on all trades connected with the erection of Orde St. School, are invited by the Board of Control, until May 1st. Plans and specifications are at the office of the Supt. of Bldgs.

Certain additions to Emmanuel Pres. Church, Swanwick Ave., are proposed and

Estimates are being received by the architect, A. McLeod, 57 Benlamond Ave.

New tenders for the erection of the R. C. Church on Dufferin St., are invited by the Architect, A. W. Holmes, 10 Bloor St. E.

The Committee of the House of Industry contemplates making large additions to the building.

Waterdown, Ont.
Plans are in progress for the erection of a R. C. church.

Westlock, Alta.
Plans for the erection of an Agricultural building are being drawn for the Westlock Agricultural Society.

Winnipeg, Man.
Tenders will be called shortly for repairs to the warehouse of B. Shragge, 400 Princess street, which was recently damaged by fire. Jas. Chisholm & Sons, architects, Enderton Bldg., are preparing plans to replace the floors and beams.

Winnipeg, Man. (St. James)
H. E. Matthews, architect, Lindsay Bldg., acting under instructions from the Public Works Department, has drawn sketch plans for the erection of a drill hall on Parkview street.

CONTRACTS AWARDED

Estevan, Sask.
The contract for the construction of the church basement for the St. John the Baptist R. C. Congregation, has been awarded to H. E. McKenzie, 4th Ave.

Edmonton, Alta.
The sub-contract for heating and plumbing in connection with the erection of the fire halls has been let to Ross Bros., 39 Grusback St., at $3,138.

Mahone Bay, N.S.
The school contract has been awarded by the Board of School Trustees to C. A. Strum & Co., Mahone Bay, N.S.

Marlboro Twp., Ont.
The following contracts have been awarded in connection with the erection of a school building for School Sec. No. 3A. General contractors and masonry, Boyde Bros., Osgoode Station. Carpentry, P. R. Mills, North Gower.

Midland, Ont.
The following contracts have been awarded in connection with the erection of the new school. General contractors, Alex. McDougall, Crompton and Yonge Sts., $41,274; plumbing, T. J. Campbell, King street, $2,102.

St. Genevieve, Que.
The school contract has been awarded by the School Commrs. to Mr. Boileau, Isle Blissard, Que.

St. John, N.B.
Sub contracts for plumbing in connection with the erection of the infirmary on Cobourg St., has been let to Geo. Blake, 88 Germain St.

Business Buildings and Industrial Plants

Aylmer, Ont.
The erection of a picture theatre, at a cost of $10,000, is proposed by John Reevely, Straffordville.

Delbourne, Alta.
The erection of an elevator is being considered by the United Farmers' Assn.

Edmonton, Alta.
A 3-storey addition to the packing plant of the Swift Canadian Co., North Edmonton, will probably be made this summer.

Fort William, Ont.
Plans for the erection of a store for the Finish Co-Operative Store Co., Simpson St., are being drawn by Architect, Fred Urry, 237 Arthur St., Port Arthur; estimated cost $6,000.

Galt, Ont.
The Maple Leaf Bedding Co., Ltd., proposes to erect a new factory, at a cost of $30,000. A site has been selected, and the company has asked the council for a loan of $12,000.

Granby, Que.
The erection of a business block is proposed by J. B. Lavigne.

Grimsby, Ont.
Plans for the erection of a store on Main St., have been drawn by Jos. Daw, 165 St. Paul St., St. Catharines, for Jas. Wray, who invites tenders; estimated cost $8,000.

Hamilton, Ont.
The A. Bell Co., Clyde Block, are considering the erection of a public garage on King St. E.

Hantsport, N.S.
The erection of greehouses, at an estimated cost of $6,000, is contemplated by Balcom, Ltd.

Montreal, Oue.
Tenders for the erection of bank premises on St. Lawrence St., for the Bank of Montreal, are invited by the Architects, Barott-Blackader & Webster, New Birks Bldg.

The Merchants Bank of Canada has purchased a site next to the present building on St. Peter St., and a new biulding will probably be erected this year.

Montreal, Que., Rosemount
A permit for the erection of store and flats on 4th ave., at a cost of $13,000 has been issued to M. Gagnon, 332 9th Ave.

Orillia, Ont.
J. R. Eaton & Sons, Ltd., are about to prepare plans for the erection of a $100,000 woodworking factory.

Ottawa, Ont.
Frank Jarman, of Bank St., is interested in the proposed erection of stores and apartments on Bank and Lisgar Sts. The estimated cost of the project is $30,000.

Regina, Sask.
A site has been purchased for the erection of a grocery warehouse, by Cameron & Heaps, Ltd., Dewdney and Hamilton streets. Plans are being prepared and work will start shortly.

A site on 6th Ave. has been secured by The Woolworth Co., Woolworth Bldg., New York, N.Y., who will erect a 3-storey building.

Sarnia, Ont.
Plans for a 3-storey store and office building, at the corner of Christinae and Cromwell, are being drawn for Dr. Kelly; estimated cost $10,000.

The erection of a furniture store is being considered by Baldwin, Robinson, Ltd., 402 Talbot St., St. Thomas; estimated cost $20,000.

Plans for stores and apartments are being drawn for Frank Gutteridge, 109 College Ave. N. Estimated cost $8,000.

Saskatoon, Sask.
The erection of a $10,000 club house is proposed by the Saskatoon Country Club, 21st St. E.

Sherbrooke, Que.
The erection of a shoe factory is contemplated by J. H. Hamilton, Levis, Que.

St. Andrews by the Sea, Que.
Barott-Blackader & Webster, New Birks Bldg., Montreal, have been appointed architects for the hotel which the C. P. R. propose erecting here.

Toronto, Ont.
The Commr. of Parks, C. E. Chambers, has planned a new play house near Elizabeth St. School. Provision for this has been included in estimates.

The erection of a branch bank, at the corner of Bloor and Lippincott Sts., is contemplated by Can. Bank of Commerce. Architects and builders, Dom. Realty Co., 34 King St. W.

Plans for the erection of a factory on Morrison St., have been drawn for J. Gingras, 459 Adelaide W., who will sublet; the old buildings now on the site ars to be razed. Estimated cost $14,500.

Vegreville, Alta.
The Co-operative Union of Vegreville propose to erect a wareouse and an elevator with a capacity of 60,000 bushels; the latest equipment is to be installed.

Wallaceburg, Ont.
Plans for the erection of a business block are being drawn by Harry Martin.

Winnipeg, Man., St. Boniface
Plans for a bank and apartments block have been drawn for the Bank of Hochelaga, by J. A. Senecal, architect, 43 Masson Ave. The contract will be awarded shortly.

CONTRACTS AWARDED

Brampton, Ont.
The contract for the construction of a number of greenhouses for E. McIntyre, has been secured by The King Constr Co.

The following contracts have been awarded on the erection of stores and offices, on Main St., for Robert Haggert. Concrete, J. Patterson; brick, J. Sewell; carpentry, R. W. Hall; steel work, Dom. Steel Co.

Goderich, Ont.
The machinery contract connected with the erection of the salt works plant for John Ransford, Maitland St., has been let to Scott & Co., Fall River, Mass., piping for the sinking of a new well will be required.

Montreal, Que., St. Henry
The contract for the erection of the Imperial Tobacco Co. warehouse on St. Antoine St., has been secured by the Atlas Constr Co., 37 Belmont St.
Simcoe, Ont.

Ottawa, Ont.
The contract for masonry connected

with the erection of stables and garage for Major & Soubliere, Nicholas St., has been let to E. Leblance, 36 Nelson.

The contract for the Simcoe Golf & Country Club house has been secured by Robt. Gunton.

Toronto, Ont.
The contract for the erection of store, dairy and apartments on Parliament St., for Geo. Kerr, Confed. Life Bldg., has been let to Thos. Brick, 716 Broadview Ave.

Residences

Edmonton, Alta.
Plans for a $40,000 apartment block on 13th ave. have been drawn for Johnson & Mexder, by J. Rudy, architect, 301 Alexander Block. The building will contain 21 3 and 4 room suites.

Hamilton, Ont.
Plans for the erection of 3 residences, on Fairholt Road, at a cost of $15,000 have been drawn for Seymour & Walker, Bank of Hamilton, by Geo. T. Evans, architect, Bank of Hamilton.

Private tenders on the erection of an apartment house, on Main St. E., are invited by B. C. Arnedt, 547 Main E.; estimated cost $10,000.

Plans for the erection of a $9,000 residence, on Eastbourne Ave., are being drawn by Geo. T. Evans, architect, Bank of Hamilton Bldg.

Plans for the erection of a $5,000 residence, on Barnesdale St., have been drawn for Seymour & Walker, Bank of Hamilton, by Geo. T. Evans, architect, Bank of Hamilton Bldg.

Montreal, Que.
Tenders for all trades except masonry will be received by the Nicholson Construction Co., Ltd., 950 St. Catharine W. on the erection of two residences on Vendome street. Estimated cost $10,000.

Plans for a $36,000 apartment house on Closse Street have been drawn for Z. St. Pierre, 101 Chomedy St., by Audet & Charbonneau, 364 Dorchester St. W.

Recent permits include, Alf. Dube, for flats to cost $5,500; Chas. Quellette, 498 Desviy St., for flats to cost $18,000; Ald. Duquette, 3136 St. Lawrence St., for flats to cost $20,000; F. A. Fraracio, 109 Lafontaine St., for flats to cost $8,000; Cerile Marcotte, 1009 Henri Julien St., for flats to cost $5,500; N. D. Leger, 3361 St. Lawrence St., for flats to cost $12,000; J. A. Godin, 269 St. Denis St., for flats to cost $9,000; Jos. Casson, 1888 Clarke St., for flats to cost $8,000; and to O. Dumont, for a residence to cost $6,000.

Montreal, Que., Notre Dame de Grace
The erection of 6 residences, at a cost of $30,000, is being considered by the Nicholson Constr. Co., Ltd., 950 St. St. Catherine W.

H. Clegg, 290 Prudhomme Ave., has had plans drawn for the erection of a $10,000 residence on Harvard St.

Plans for the erection of 4 residences, to cost $40,000, have been drawn for C. J. Brown, 4263 St. Catherine W.

Montreal, Que., Outremont
Plans for the erection of a $10,000 residence, have been drawn for D. Abel, 2156 St. Urbain St.

Plans for the erection of a $28,000 residence, on Hutchison, have been drawn for Miss O. Provencher, by A. Carbonneau, architect, 27 Casgrain.

Montreal, Que., Westmount
Plans for the erection of a residence and garage on Edgehill Rd., have been drawn for W. E. M. Shepherd, Coristine Bldg., by Herbert Raine, architect, 808 New Birks Bldg.

D. J. Spence, architect, 46 Beaver Hall Hill, Montreal, has drawn plans for the erection of an apartment block on Sherbrooke and Oliver streets.

Plans for an apartment house, on Westmount Park, are being drawn for N. S. Gohier, by L. R. MontBriant, architect, 230 St. Andre St., Montreal, who will call for tenders shortly.

Orillia, Ont.
Tenders on the erection of a $10,000 residence, on Peter St., for Geo. H. Clarke, are invited by the architect, W. H. Croker, Atherley, Ont., until May 1.

Ottawa, Ont.
The erection of a $6,000 residence, on Belmont St., is proposed by B. A. Grierson, 100 Fentiman St.

The erection of a 4-storey apartment house, on O'Connor St., is being considered by David Epstein, Ottawa Apts.

Summerside, P. E. I.
Albert Baker, architect, has drawn plans for a $6,000 residence at the corner of Summer and Church Sts., for J. Leroy Holman.

Plans for the erection of a $6,000 residence, on Central St., are being drawn for Hilliard Muttart, by Geo. Baker, architect.

Toronto, Ont.
Tenders on the alterations and additions to 178 Jamieson Ave. are invited by the architects, Edwards & Saunders, 18 Toronto street.

The erection of a lodging house is proposed by the Methodist Social Union, and the Board of Health is considering the proposition. Estimated cost $125,000.

Tenders on the erection of a $6,500 residence, on Scarth Rd., are invited by P. McKissock, 526 Bathurst St. Craig & Madill, Manning Chmbrs., is the architects.

Plans for the erection of 2 detached residences, on Bracondale Ave., have been drawn for P. W. Coltman, 167 Robert St. Estimated cost $11,000.

Whitby, Ont.
Plans for the erection of a rectory for St. Johns Roman Catholic Church are being drawn by J. H. Haffa, 209 Peterkin Bldg., Toronto.

Windsor, Ont.
The erection of a bungalow, on Ouellette St., is contemplated by a client of J. C. Pennington, architect, La Belle Building.

Winnipeg, Man.
A permit for the erection of a residence, on Elm St., to cost $6,500, has been granted to Purcer Bros., McIntyre Block.

A permit for the erection of a $8,000 residence, on Cathedral Ave., has been granted to A. E. Hyde, 6 Bannerman Block.

McCrae & McKenzie, McIntyre Block, propose to erect about 20 residences during the current year; the cost will vary between $4,000 to $6,000 each.

It is understood that the City & District Land Co., 6th Floor, McArthur Bldg., will build a number of residences this year.

CONTRACTS AWARDED

Coteau du lac, Que.
The carpentry contract connected with the alterations to the residence of L. A. Wilson, has been let to M. J. Aquin, Lachine. The other contracts will be awarded shortly.

Hamilton, Ont.
The following sub contracts have been awarded on Mr. J. E. Dodson's residence on Emerald St. S. Carpentry, L. J. Beatty, 175 Emerald St. S.; galvanized iron work, V. Drew, 261 Cannon St. E.; tile work, Kent-Garvin Co., 160 King St.; heating and plumbing, Jas. H. Stuart, 36 Jackson St. E.; electrical, Culley & Breay, 35 King St. W.; drain J. J. Armstrong & Son, 48 Burris St.; plastering, Hill Bros., 307 Emerald St. N.

The following contracts have been awarded on the erection of Mr. J. H. Salter's residence, on Chedoke Ave. Masonry, Chas. Kidd, 90 Burris St.; carpentry, Stuart Bros., Hyde Park Ave.; galvanized iron work, J. E. Riddell & Son, Ferguson St. N.; tile work, Middleton Marble & Granite Co., 232 King St. E.; plastering, Hill Bros., 307 Emerald St. N.; painting, J. Kenyon, 293 Wentworth St. N.; heating and plumbing, W. J. Walsh, 215 King St. E.; electrical, Culley & Breay, 35 King St. W.; drains, J. D. Armstrong, 138 Erie Ave.

Montreal, Que.
The contract for the erection of two residences on Vendome street for Arthur Birks, 39 Youville Place, has been let to L. P. Perham, 332 Bleury street.

The contract for the erection of a residence for Mrs. St. Elizabeth, 217 St. Hubert, has been let to R. Laberge, 141 Convent St.

The contract for the erection of a residence for O. Belanger, 680 St. Hubert St., has been secured by E. Leblanc, 221b Waverley St.

The contract for alterations to the factory of A. Aubry & Fils, Ltd., 600 Delorimer, has been let to Guertin Bouchard, 410 Parthenais.

The following contracts connected with the alterations to the residence of J. K. L. Ross, 355 Peel St., have been awarded. General contractors, Jno. Stewart & Co., Bethune St. Carpentry, Wm. Irving, Guy Block, St. Catherine W.

St. Anne de Belleview, Que.
A. T. Hawke, St. Anne de Belleview, has secured the contract for the erection of a residence for Mr. R. A. Winters. Architects, Gordon & Aird, Stanley St., Montreal.

Toronto, Ont.
A contract for the erection of a residence on Douglas Drive for G. C. Moore, has been awarded to [illegible] & [illegible], [illegible] Price street.

Continued on page [illegible]

Tenders and For Sale Department

TOWN OF ESTEVAN

Province of Saskatchewan

Notice to Contractors

Sealed tenders endorsed on envelope "Tender A," "Tender B," etc., as the case may be, will be received by the Secretary-treasurer until 8 p.m. on **Saturday, May 9th, 1914**, for the following works:—

Contract "A"—Laying Watermains and sewer pipes (approximately 10,500 feet of watermains and 16,000 feet sewer pipe).

Contract "D"—Furnishing cast iron water pipe and specials.

Contract "E"—Furnishing fire hydrants and gate valves.

Contract "F"—Furnishing sewer pipe and junctions.

Plans, specifications and forms of tender may be seen at the Town Engineer's office, Estevan, Sask., or at the office of the "Canadian Engineer," Winnipeg, on and after April 10th, 1914.

Complete set of specifications, etc., but not plans, will be sent to contractor on receipt of Five ($5.00) Dollars, which amount will be refunded on return of such.

The lowest or any tender not necessarily accepted.

JAS. A. SMITH, Mayor,
P. J. STEPHENS, Sec.-Treasurer.
H. V. ARMSTRONG, Town Engineer.

14-16-17

Town of Kamsack

Province of Saskatchewan

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 2 p.m., **Wednesday, May 13th,** for the following works:—

Contract "A"—Labor, laying Water Mains and Sewers.

Contract "B"—Power House and Filter House.

Contract "C"—Furnishing Materials for, and Erecting Water Tower.

Contract "D"—Furnishing Cast Iron Water Pipes.

Contract "E"—Furnishing Fire Hydrants and Valves.

Contract "F"—Furnishing and Installing Pressure Filters.

Contract "G"—Furnishing and Installing Pumping Machinery.

Contract "H"—Furnishing and erecting Boilers.

Contract "J"—Furnishing and erecting Steam Engine.

Contract "K"—Furnishing and erecting Generator.

Contract "R"—Labor and Material for construction of Concrete Reservoir.

Contract "S"—Furnishing Sewer Pipe.

Contract "T"—Construction of Concrete Walk.

Contract "X"—Labor and Material for construction of Sewage Disposal Works.

Alternative bids will be received for Gas Producers, and Engines in place of Boilers and Steam Engine, of same capacity.

Plans and specifications may be seen at the office of the Engineers, Toronto and Winnipeg, and at the Town Hall, Kamsack.

No tender necessarily accepted.

E. J. JOHNSON, Esq., Mayor,
Kamsack, Sask.
A. A. CRAWFORD, Esq., Sec.-Treas.,
Kamsack, Sask.
CHIPMAN & POWER, Engineers,
Toronto and Winnipeg.

16-17

Concrete Pavement

Tenders for approximately 4,500 yards of Concrete Pavement, will be received by the undersigned up to 5 o'clock p.m., **Saturday, May 9th.** Plans and specifications may be had at the City Engineer's Office.

M. FERGUSON,
City Engineer.

St. Thomas, April 24, 1914.

Notice to Contractors

Sealed tenders will be received by the undersigned, up to and including **May 2nd, 1914**, for the erection of the Kintore Presbyterian Church, according to the plans and specifications. Tenders to be either for the whole contract, or for part thereof. The lowest or any tender not necessarily accepted. Plans and specifications can be seen at the following places: Journal Office, St. Marys; William Crellin's Store, Kintore, and at the office of Wm. J. Murray, Architect, London, Ont.

GEO. B. ANDERSON,
Secretary, Building Committee,
R. R. No. 1, Lakeside, Ont.

16-17

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Port Hope, Ont.," will be received at this office until 4 p.m. on **Monday, May 11, 1914**, for the construction of Harbour Improvements at Port Hope, Durham County, Ontario.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department and at the office of Mr. J. G. Sing, Esq., District Engineer, Confederation Life Bldg., Toronto, Ont., and on application to the Postmaster at Port Hope, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $25.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, April 11th, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—59348.

16-17

Tenders for the Construction of a Reinforced Concrete Bridge on Crawford Street over Bellwoods Park

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, June 2nd, 1914**, as follows:—

For the complete construction of a reinforced concrete bridge on Crawford street over Bellwoods Park.

Specification and tender form may be obtained upon application at the office of the Railway and Bridge Section, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
April 21st, 1914.

17

Tenders for Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, May 12th, 1914.**

Drinking Fountains
Paving Pitch and Filler
Rubble Stone

Specification and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
April 21st, 1914.

17

CITY OF BERLIN

Tenders for Creosoted Wood Block Pavement

Sealed tenders addressed to A. H. Millar, City Clerk, will be received up to 5 o'clock p.m., April 30th, 1914, for approximately 21,422 sq. yards of Creosoted Wood Block Pavement in the City of Berlin. Plans and specifications may be seen at the office of the "Contract Record" and "Canadian Engineer," Toronto, and at the office of the City Engineer. The lowest or any tender will not necessarily be accepted. 15-17

HERBERT JOHNSTON,
City Engineer.

Tenders for Sewerage Works

City of Sault Ste Marie, Ont.

Sealed tenders, fully endorsed, and marked "Tender for Sewerage Works," addressed to T. E. Simpson, Mayor, Sault Ste. Marie, Ont., will be received by the City Clerk, up to five o'clock p.m., on **Tuesday, May 26th, 1914**, for supplying and laying about 11,800 lineal feet of tile sewer pipe, with appurtenances.

Specifications and plans may be seen and all information and forms of tender obtained at the Office of the City Engineer, Sault Ste. Marie, Ont.

A marked cheque for 5 per cent. of the amount of the tender, payable to the order of the City Treasurer, must accompany each tender.

The lowest or any tender not necessarily accepted.

17-18 C. J. PIM, City Clerk.

Department of Railways and Canals, Canada

Hudson Bay Railway Terminals

Port Nelson, Man.

Sealed tenders, endorsed "Tender for Provisions" or "Tender for Hardware Supplies," as the case may be, will be received by the undersigned, up to 16 o'clock **Tuesday, May 5th, 1914**, for the furnishing of the above, to be delivered in such quantities at Halifax, N.S., and at such times as may be directed.

Dealers may tender for the total quantities required, or for such portions thereof, as may suit their convenience.

Specifications of requirements, and full information can be obtained from the Purchasing Agent of the Department of Railways and Canals, Ottawa, on and after this date.

Accepted bank cheque for $1,000 and $500 respectively, made payable to the order of the Minister of Railways and Canals must accompany each tender, which sums will be forfeited if the party tendering declines entering into contract for [illegible] or in any way fails to properly fulfill the same.

The cheque thus sent in will be returned to the respective tenderers whose tenders are not accepted.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary

Department of Railways and Canals,
Ottawa, [illegible] 1914

Newspapers [illegible] without authority from the Department will not be paid for it.—59816. 16-17

Hydro-Electric Power Commission of Ontario

Sealed tenders will be received up to 4 p.m., **Monday, May 18th, 1914**, for the construction of dams, head-works, etc., and for the excavation of a canal in connection with a power development at Eugenia Falls.

Plans and specifications may be seen and forms of tender obtained at the offices of the Commission on and after Monday, May 4th, 1914.

Parties receiving plans and specifications will be required to deposit a marked cheque for $5.00 with the Secretary of the Commission pending the return of the same in good order, either with or without a tender.

By order,
W. W. POPE, Secretary.

Hydro-Electric Power Commission,
Continental Life Building,
Toronto, Ont.

Parties inserting this advertisement without written authority will not be paid for same. 17-18

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, May 12th, 1914**, for the construction of the following sewers, viz:—

Armand Ave., south end to north end.
Ashdale Ave., Felstead Ave. to 129 feet south.
Bracken Ave., Scarborough Rd. to Victoria Park Ave.
DuVernet Ave., Woodbine Ave. to Armand Ave.
East Toronto Drainage System, Section "A," outlet from Woodbine Ave. and 150 feet north of Heyworth Cres. to Glenmount Park Road and Burgess Ave. via lots 22, 23, 24, 25, 26, 30, 39, 28, 20, 21, 26 Armand Ave.; lots 11, 264 Gibson Ave.; Brookside Drive and Burgess Ave.
Fourth Ave., Sixth Ave. to Third Street.
Gerrard St., Eighth Ave. to Woodbine Ave.
Glenmanor Drive, Queen St. to south limit Lot No. 11.
Glenmanor Drive West, south limit Lot No. 11 to Williamson Road.
Kingswood Ave., Kingston Road to Gerrard St.
Lane first north Baldwin St., McCaul St. to Henry Street.
Lane first south College St., Palmerston Ave. to Euclid Ave.
Lane second south College Street, Palmerston Ave. to Markham Street.
Lane first east Denison Ave., Wolseley Street to Carr Street.
Lane first south King Street, John Street to Peter Street.
[illegible] to west end.
Lane first east Windsor Street, Adelaide Street to lane first north King Street.
Seventh Street, Gerrard Street to Eighth Ave.
Sixth Ave., Fourth Ave. to Gerrard Street.
Tomlin Ave., Woodbine Ave. to east end.
Western Ave., Conduit Street to 105 feet north.

[illegible] City Treasurer, or in lieu of said sureties, the [illegible] with.

The lowest or any tender not necessarily accepted.

[illegible], Mayor,
Chairman, Board of Control.
[illegible] 1914 17

City of Regina

Sewers

Sealed tenders, marked "Tender for Sewers," and addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, **May 25th, 1914**, for the construction of storm and domestic sewers.

A copy of specifications will be furnished to intending bidders upon receipt of a marked cheque for $25.00 made payable to the City of Regina, said cheque will be returned to bidder on the receipt of a bona fide tender and the return of specifications.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The City reserves the right to divide the works into two or more contracts and to reject any or all tenders.

17-19 F. McARTHUR, City Engineer.

City of Regina

Pavements

Sealed tenders, marked "Tender for Pavements" and addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, **June 1st, 1914**, for the construction of 113,000 square yards of pavement.

A copy of specifications will be furnished to intending bidders upon receipt of a marked cheque for $25.00 made payable to the City of Regina, said cheque will be returned to bidder on the receipt of a bona fide tender and the return of specifications.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The city reserves the right to divide the works into two or more contracts and to reject any or all tenders.

17-19 F. McARTHUR, City Engineer.

Board of Education

Toronto

Tenders Wanted

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

FRIDAY, MAY 1st, 1914,

[illegible]

New School Building, Orde St.

and for

Ash Hoist and Plumbing at Essex Street School

Tenders Will Also Be Received For Sale of a Number of Old Houses

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall. [illegible] cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in [illegible] in the City Hall not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

[illegible]

J. W. JACKSON,
[illegible]

W. [illegible]
[illegible]

[illegible] 1914 17

Agents Wanted

[illegible] manufacturing water level [illegible] engineering equip[illegible] in Eastern Canada, [illegible] West. Apply Box 10, Contract Record & Engineering Review, Toronto.

16-19

Contractors' Outfit For Sale

Suitable for Sewer and Water Works Construction

One Parsons Trenching Machine, Concrete Mixers, pumps, trench braces and other tools, being a complete outfit.

Can be seen at Prince Albert, Sask., Canada. Information, write

HUGO & TIMS COMPANY,
Duluth, Minn.

14-17

MEDICINE HAT, ALBERTA

Tenders for the General Contract of the New Technical High School

Sealed tenders addressed to James L. MacCallum, Secretary of the Medicine Hat School Board, and endorsed "Tenders for the General Contract of the Technical High School," will be received up to 5 o'clock p.m., **June 1st, 1914**. Full particulars may be had at the office of McCoy & Levine Engineering Company, Huckvale Bldg., Medicine Hat.

An accepted cheque made payable to McCoy & Levine for the sum of ten dollars ($10.00) will be required from each contractor taking out plans and specifications on this work as a guarantee that they will put in a bona fide tender and return plans and specifications.

Each tender must be accompanied by an accepted cheque payable at par Medicine Hat, to the Medicine Hat School Board to the amount of two (2) per cent. of the tender.

Should the contract be awarded, the successful bidder shall be required to execute a guarantee bond on an approved surety company to the amount of twenty (20) per cent. of his tender as a guarantee for the faithful fulfillment of his contract.

The Cheques of the unsuccessful bidders will be returned within six days after the contract is awarded.

The right is reserved to reject any or all bids or to waive any defects.

The lowest or any other proposals not necessarily accepted.

McCoy & Levine Engineering Co.

Dated at Medicine Hat,
This 24th day of April, 1914.

17-18-19

Town of Shoal Lake, Manitoba

Electric Lighting

Sealed tenders, addressed to the undersigned, will be received up till 18 o'clock on **Thursday, May 28th, 1914**, for the following contracts:—

1. Furnishing and installing Semi-Diesel Oil Engine.
2. Furnishing and installing D.C. Generator, Booster and Switchboard.
3. Furnishing and installing Storage Battery.
4. Construction of concrete and frame power house building.
5. Supply of Poles, Line Supplies, Copper Wire, D.C. Meters, and Tungsten Street Lighting Equipment.
6. Erection of Pole Line.

Tenders must be accompanied by an accepted cheque for ten per cent. of the amount of the tender, or alternatively by the bond of an approved guarantee company.

Plans and specifications may be seen at the offices of the Consulting Engineers at Winnipeg and Calgary, and at the Town Hall, Shoal Lake, A deposit of $25.00 will be required on Contracts Nos. 4 and 6, which will be returned to bona fide tenderers on return of the plans.

The Corporation do not bind themselves to accept the lowest or any tender.

F. DOBBS, Secretary-Treasurer,
Shoal Lake, Man.

The John Galt Engineering Co., Ltd.,
Consulting Engineers.

April, 1914.

17

Tenders for Centrifugal Pumps

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, May 19th, 1914**.

One or more 24,000,000 gallon Centrifugal Pumps and Engines

Specification and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, April 23rd, 1914.

17

Positions Wanted

To Architects.—Superintendent of works is open for re-engagement. Familiar with all kinds of office buildings, schools, banks and hospitals. Ready to take charge of works at once. Reply "Superintendent," Contract Record, Toronto.

17-18

First Class Steel Inspector wants re-engagement by June 1st as inspector or foreman of structural steel. Advertiser, 21 Sullivan Street, Toronto.

17-19

Residences

(Continued from page 79)

Windsor, Ont.

The following sub contracts have been awarded in connection with the erection of a double residence, on Pelissier, for Mrs. A. C. Chase. Roofing, heating and plumbing, Pennington & Brian; plastering, Frank Phillips; painting, Wm. Laesser; electrical, James Clark.

Power Plants, Electricity and Telephones

Chatham, Ont.

The city council has received a report from Engineer Jeffrey of the Provincial Hydro-electric Commsn., recommending the installation of a hydro-electric plant. The estimated cost is $89,000.

Edmonton, Alta.

The bylaw providing for street railway extensions, at a cost of $168,386.67, has been passed and the work will be done this summer.

London, Ont.

The London Street Railway Co. has under consideration extensions to the system.

Medicine Hat, Alta.

The Ogilvie Flour Mills Co., Ltd., contemplate installing electric power in their mill in place of gas, about 1,300 h.p. will be required.

The estimates for electric wiring, etc., have been completed. Gas lamp posts, mantels, burners, etc., will also be required. Engineer, A. K. Grimmer.

Weyburn, Sask.

A by-law will be submitted to the ratepayers May 5th, for authority to raise money for furnishing the electric lighting plant with engine and generator and for erecting a steel smoke stack.

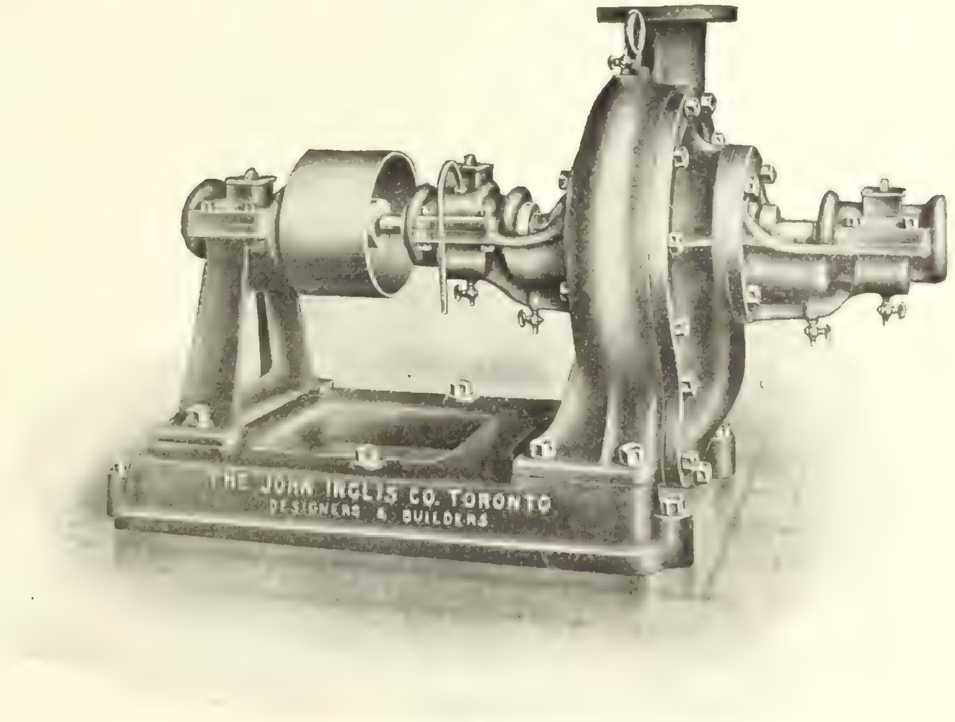
For Sale

1 Dumping cradle cableway. 2 spans, 1100 feet each—complete, in perfect working order.
1 Model 60 Marion steam shovel, used one season.
2 Improved style "A" Marion shovels.
2 Locomotives, consolidation type. Cylinders 20" x 26".
1 Standard gauge locomotive. Cylinder 18" x 26".
4 Saddle tank dinkies, standard gauge. Cylinders 10" x 14".
50 4-yard, two-way, standard gauge dump cars, $52.00 each.

This equipment is in perfect condition. Immediate shipment.

W. FRASER, 83 Craig St. West, MONTREAL
P. O. Box 792

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

220 King Street West, Toronto

Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

HUMBER BRICK YARDS
Lime, Sewer Pipe and Fire Brick

JOHN MALONEY
Cor. Queen and Dufferin Sts., TORONTO
Office Phone Park. 64 **Residence Phone Junct. 3429**

Raising the Wreck of U.S. Battleship Maine

Bulletin 102 **Edition 2**
Just off the Press

The perfect behavior of

Lackawanna Steel Sheet Piling

in the Maine work through the driving, filling of cofferdam pockets, unwatering and pulling of piling offer strong evidence of the success which is achievable in cofferdam and foundation work by proper use of this sheet piling. A copy of this bulletin will be sent to engineers and contractors on application.

H. A. Drury Co. Limited
Montreal and Toronto

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Continuous Bucket Stone Elevator

handling 300 tons per hour. Note the absence of tracks. The chains are guided by large flanged rollers. This is a heavy slow speed elevator, designed for long life.

STEEL BUCKET ELEVATORS

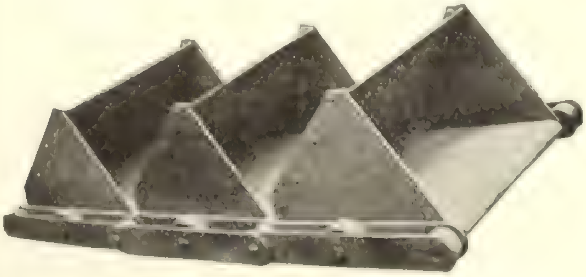
For Sand, Stone, Gravel, Etc.

For the contractor who is handling large quantities of sand, stone, gravel, and other rough material, a Waterous Steel Bucket Elevator will effect economies in time and labor that are worth consideration.

We build Elevators and Conveyors on the Link Belt System, in sizes ranging up to 600 tons per hour capacity, designed and arranged to suit special installations.

Years of experience building transport equipment are built into these conveyors. Send us your sketches and let us figure on a cost-cutting installation for you.

We build Steel Buckets of all types, in any size. Write for prices. Catalogues on request.



The Waterous Engine Works Company, Limited
BRANTFORD - CANADA

BROWNING
LOCOMOTIVE
CRANES

THE BROWNING COMPANY
CLEVELAND, O

Sales Offices
New York Philadelphia
Chicago Pittsburg
San Francisco

THESE PARTITION DOORS ARE A PERFECT SUBSTITUTE FOR ALL CONTRIVANCES HERETOFORE KNOWN WHERE IT IS DESIRABLE TO CONVERT TWO OR MORE SMALL ROOMS INTO ONE LARGE ONE

Springer's

Folding Door and Partition Hanger

is far ahead of all other dividing doors for simplicity of construction, inexpensiveness of material and adaptability.

No track on floor required.

Perfect balance.

Write for booklet.

O. T. SPRINGER - Burlington, Ontario

Electric Generating Plants

DIRECT RUNNING
AUTOMATIC
OR
STORAGE
BATTERY SETS

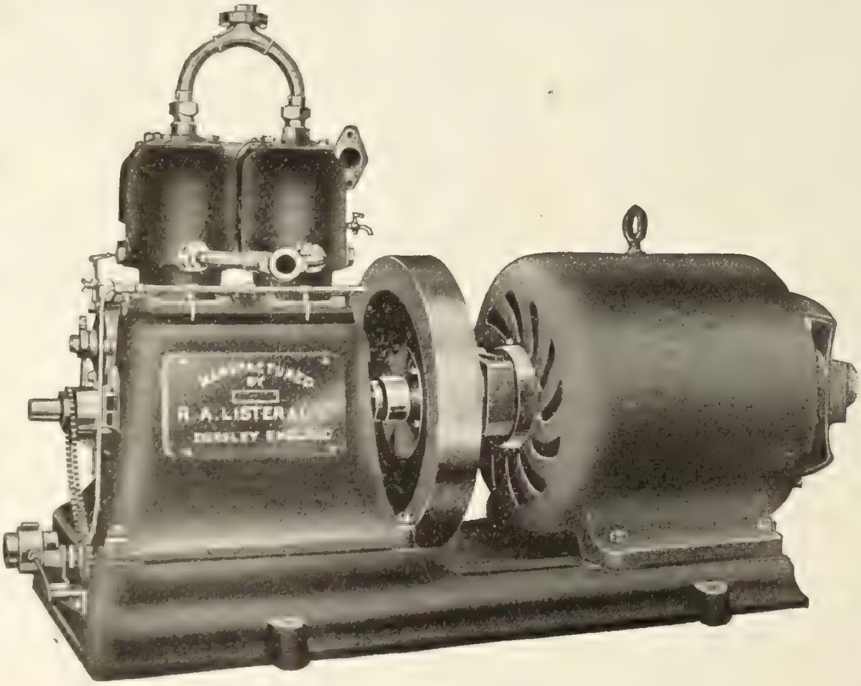
Description

Direct Coupled or Belt Driven.

One, Two or Four Cylinder Engines.

Stocked in 50-60, 110-115 and 220 volts.

.5, .75, 1.00, 1.6 2.0, 2.6, 3.5, 4.0, 5.0, 6.0, 10.0 and 12.0 kilowatts capacities.



6 K.W. Generating Set

Hundreds in Use For

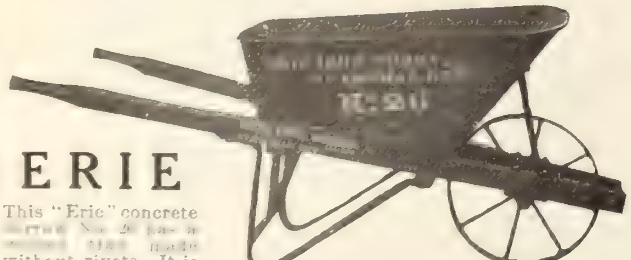
Small Towns.
Moving Pictures.
Street Lighting.
Mining Plants.
Contractors' Plants
Hotels.
Country Houses
Factories.
Etc., Etc.

Running on Gasoline, Natural Gas, Town gas and Kerosene.

Send for Catalogue "E" and Prices.

R. A. LISTER & COMPANY, LIMITED

Winnipeg 58-60 Stewart St., TORONTO St. John, N. B.



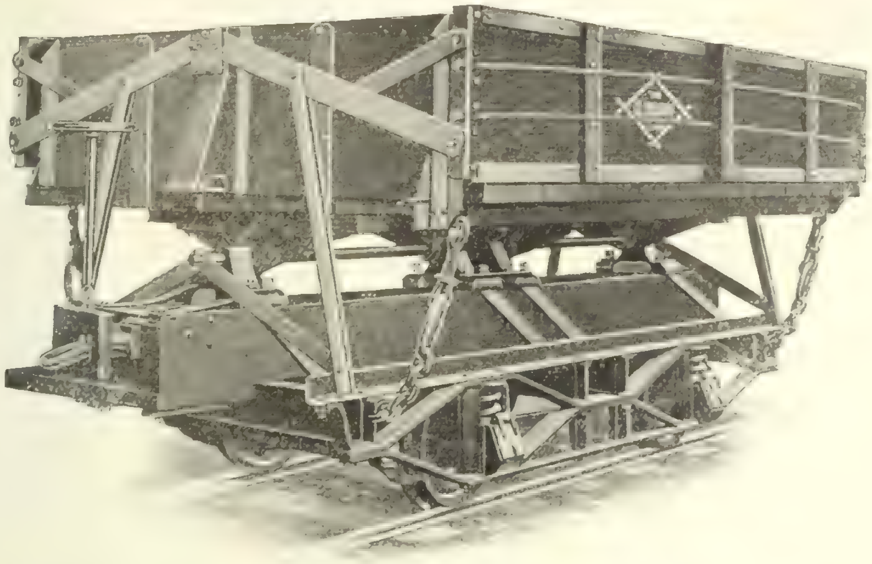
ERIE

This "Erie" concrete barrow No. 20 has a welded tray made without rivets. It is watertight and cannot burst open. Well braced channel iron legs; wheel guarded; forward or side dump.

Concrete Barrow

This barrow No. 34 has a welded tray, no rivets and is absolutely watertight. Wheel guarded and has forward or side dump. WRITE US.

The Erie Iron Works, Limited - St. Thomas, Ontario



Cut showing 4 and 6 yard Double Diamond Steel Frame Side Dump Car. Better value for your money has not been offered.

We want you to ask us why this car is a better car. The simple facts will astonish you. Will you write us now?

GLENGARRY

This Steel Frame Car is Made in Canada

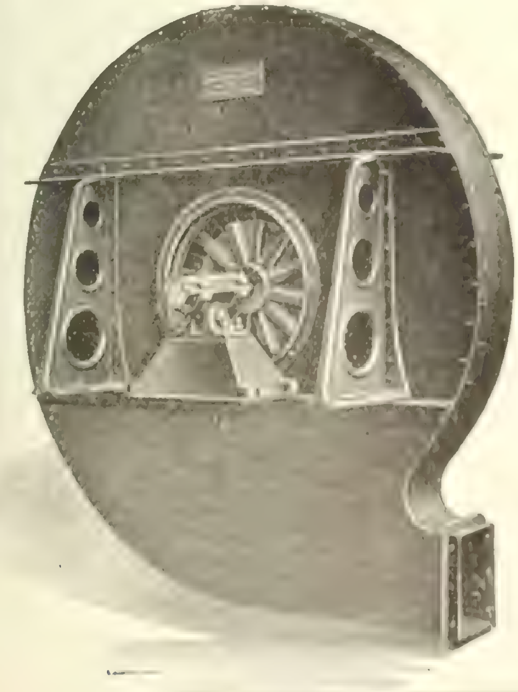
There is no necessity for contractors to go across the line for good steel frame cars. We have not designed these cars over night. A whole year has been given to the careful thought of building a better car than any now sold. To stand behind this claim it must have the points. Let us show you where we give you better value and better prices!

The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

---

Your Cupola — Are You Giving it a Fair Chance?

Is it assisted by a Blower that provides for perfect combustion of the fuel?
Does it produce sufficient pressure to overcome the resistance within the cupola?



"Sirocco" TRADE MARK. **Special Steel Pressure Blowers**

do these all-important things and at a lower cost for power than blowers of other types or even of the same type.
There are no frictional surfaces to "eat up" power in a "Sirocco" Blower. The bearings are self-aligning and self-oiling. Being independent of the housing prevents vibration.
The speeds of "Sirocco" Blowers are adaptable to direct connection to electric motors and steam turbines, thereby eliminating the usual belt and gear power losses.
Every ounce of energy put into a "Sirocco" Special Steel Pressure Blower goes to propelling air.

Write for Bulletin No. 8. It contains helpful information on Pressure Blowers

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR, ONTARIO.

—Sales Engineers—

C. T. MORSE	E. C. POWERS	W. P. EDDY	S. S. CLARKE
[illegible] McGill Bldg., Montreal	[illegible] Victoria Street, Toronto	[illegible] Donald Street, Winnipeg	[illegible] Calgary

THE H. & E. PATENT BALL-BEARING LIFTING JACK

For Railway and Bridge Work, Contractors' and Builders' Use

Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

Manufactured by

CANADIAN BRAKESHOE CO., LIMITED
SHERBROOKE, QUE.

Sole representatives for the sale of our Brakeshoes in the Dominion of Canada outside British Columbia—Messrs. Taylor & Arnold, Montreal and Winnipeg. The Province of British Columbia—The B. C. Equipment Co., Vancouver.

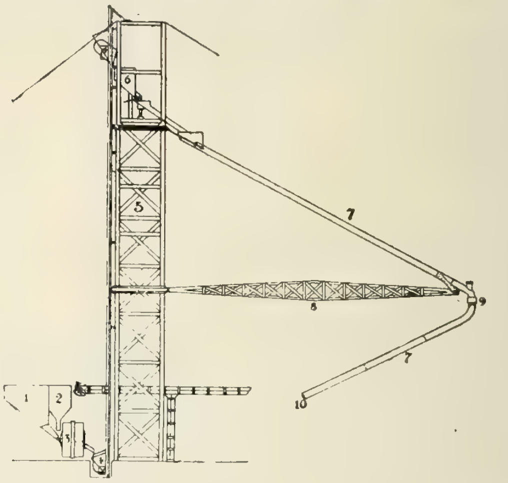
Stock carried by F. H. Hopkins & Company, Montreal

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the Contract Record and Engineering Review. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario



Gravity System Distributing Concrete

A system that improves the concrete and reduces the cost.

Information gladly furnished and Estimates given on any work.

Canadian Concrete Appliance Co. Limited
Sole Licensees for Canada
613 Vancouver Block, VANCOUVER, B. C.
Eastern Representatives—
STINSON REEB BUILDERS' SUPPLY CO., LTD., MONTREAL, P.Q.

"SAFETY FIRST"

Roelofson Elevator Works

Manufacturers of

FREIGHT AND PASSENGER

ELEVATORS

ELECTRIC, HYDRAULIC, HAND POWER

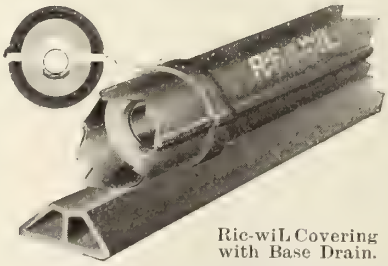
Dumb Waiters, Motors and Controllers

Galt, Ontario

Not only is SAFETY FIRST,

in the Ric-wiL method of insulating underground steam pipes but EVERY NECESSARY ESSENTIAL in covering underground pipes.

The system with the INTERLOCKING BASE DRAIN which, with the tile, is the most COMPACT insulating method.



Ric-wiL Covering with Base Drain.

Tile and Insulation Are In One Piece.

Write for Catalogue W.

THE Ric-wiL UNDERGROUND PIPE COVERING CO.
66 New England Bldg., CLEVELAND, Ohio.
Canadian Sales Agents—Gen. Mfrs. Agencies, Ltd., Toronto and Montreal.

Wooden Water Pipe

**Galvanized Wire Wound and Continuous Stave Pipe
for Water Works, Power, Irrigation, etc.**

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915

Factory: 550 Pacific St., VANCOUVER, B. C.

Another Big Contract

The new plant of the Northern Aluminum Company, Toronto. The contract for roofing and sheet metal was executed by us

We specialize in

The Built up Pitch, Felt and Gravel Roofing, Damp-proofing Foundations, Slating, etc.

We also manufacture

SKYLIGHTS, CORNICE, FIRE DOORS AND WINDOWS, TIN CLAD DOORS, ASPHALTS, TARRED AND DRY FELTS, COAL TAR PITCH

We will quote you attractive prices on any of the above—write us

REGGIN AND SPENCE

Roofing and Sheet Metal Contractors

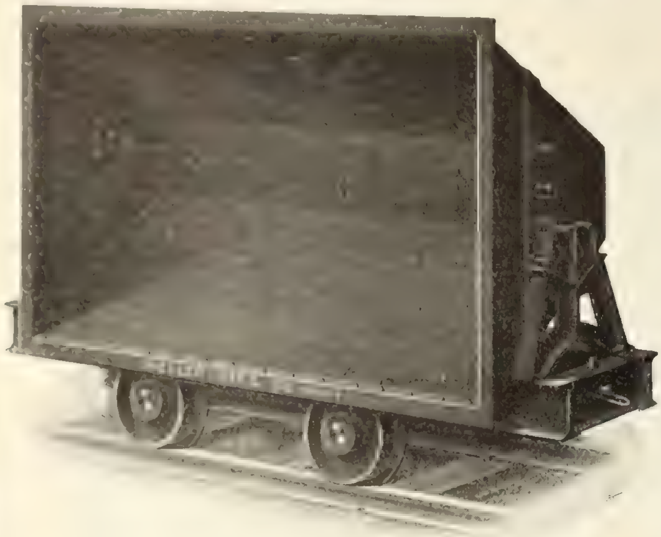
530 Front Street West - - Toronto

WELLER-MADE

Whatever your Elevating, Conveying or Transmission problems are the Weller Machinery will solve them correctly, quickly and inexpensively.

This is effected by the Weller Engineering Department, whose experience in prescribing for specific conditions can best appreciated when [illegible]

Write for our No 29 catalog describing Weller Machinery in full.



DUMP CAR

WELLER MFG. COMPANY, CHICAGO

New York Office, 50 Church St. 1520 Victoria Bldg., St. Louis, Mo.

CANADA WIRE & CABLE CO. LIMITED CANADA TORONTO CANADA

New Code Rubber Covered Wires AND Cables

Manufactured in accordance with specifications of the National Board of Fire Underwriters.

All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

Price list and discounts on application to head office or nearest agent.

Canada Wire & Cable Co., Limited

1160-1170 Dundas Street
Toronto Canada

Sales Offices

401 Lake of the Woods Bldg., Montreal, Que.
A. E. Esling, 150 Princess St., Winnipeg, Man.
Macdonald, Marpole Co., Ltd., 427 Seymour St., Vancouver, B.C.

Service

We have unequalled facilities for making prompt shipments and can guarantee deliveries to date.

Our line of bricks comprises

RED PRESSED BRICK
RED WIRE-CUT BRICK
RED RUFFESTRY BRICK
FLASHED PRESSED BRICK
FUSED PRESSED BRICK

Write us for samples and prices

Russell Shale Bricks, Ltd.
RUSSELL, ONT.

MACHINERY FOR SALE

1—1 yd. Smith Concrete Mixer
1—½ yd. Smith Concrete Mixer
1—12 h.p. Portable Boiler and Engine
5 Steel Skips
15 Steam Rock Drills
4 General Service Duplex Steam Pumps
15 Vertical Boilers 4 to 25 h.p.
1—7500 Cram Steam Pile Hammer
5 Extra Heavy 2-yd. Dump Wagons
2—8 x 5 Lidgerwood D.C. S.F.D.Hoisting Engines
3 Centrifugal Pumps
50—4 yd. two way 36 in. gage Dump Cars
4 Derricks & Derrick Irons
1—3 ton Motor Truck
24 Water Wheels—various sizes and makes

All in good condition. Full particulars and prices on application.

Fleming Machinery Company
345 Sparks Street - Ottawa, Ont.

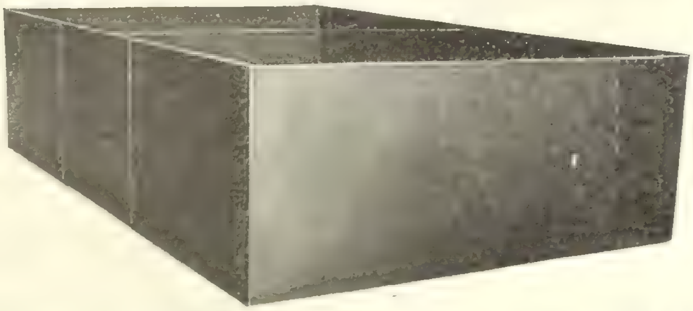
STEEL

BOILERS
STACKS

We Specialize in This Class of Work.

Any Shape or Size.

All Workmanship Guaranteed.



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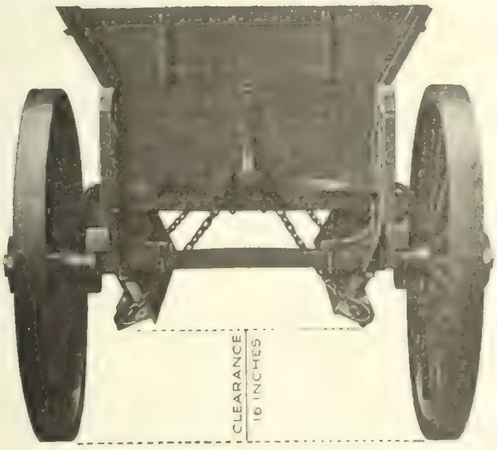

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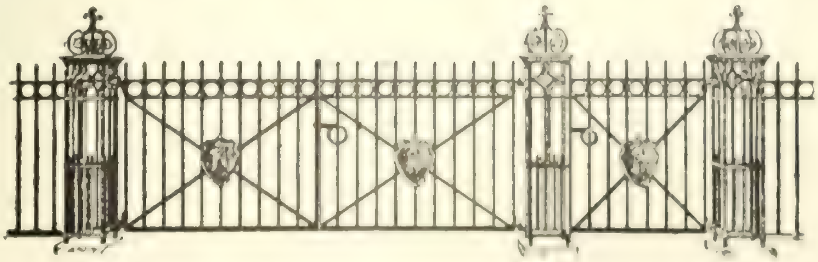

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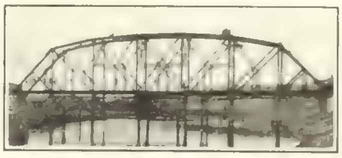

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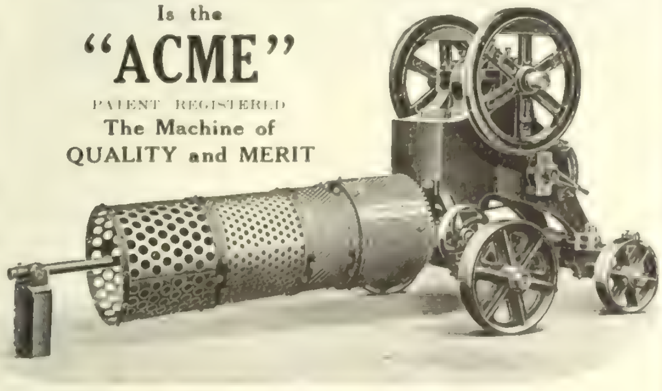

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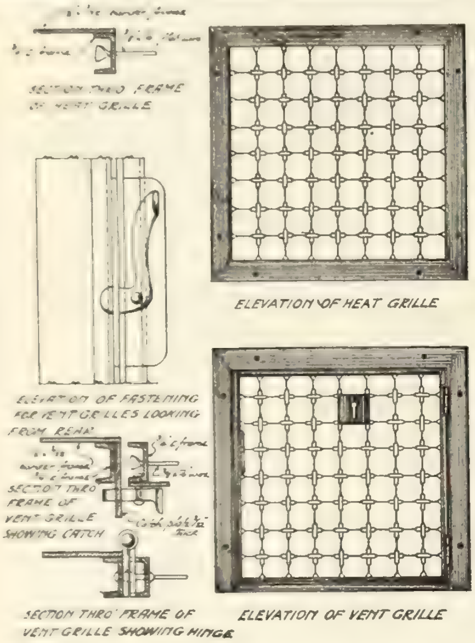
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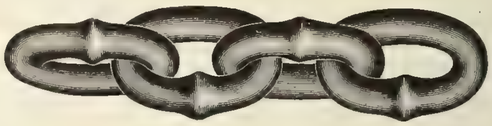

has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.

Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16" to 3/4" inclusive.

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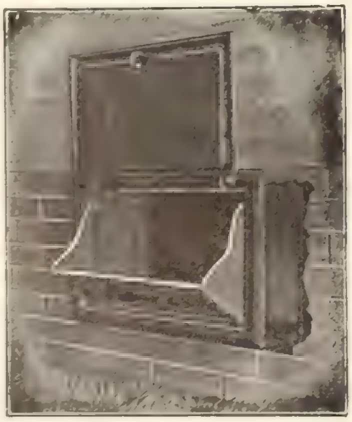

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

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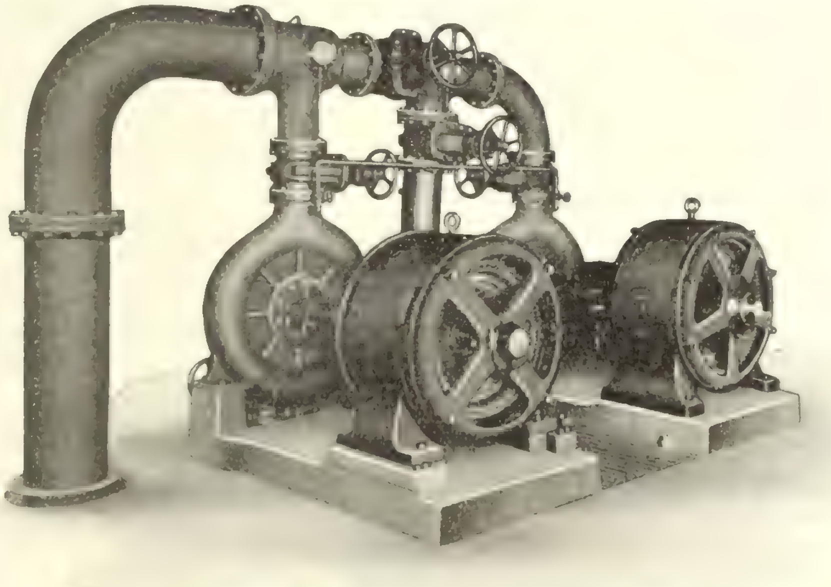

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For further particulars ask

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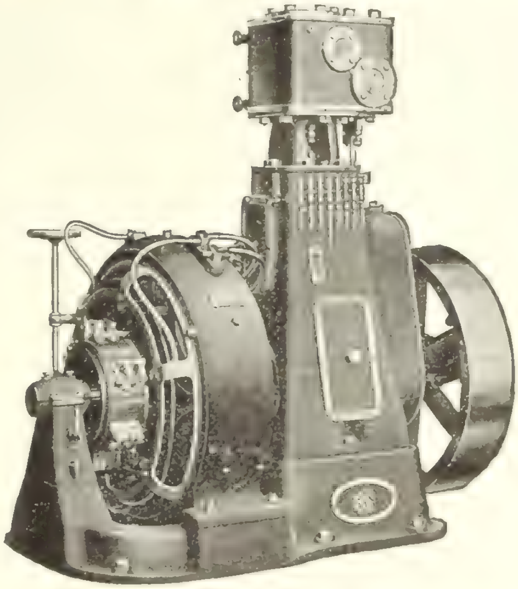

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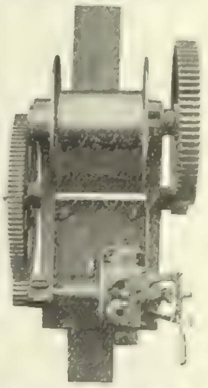

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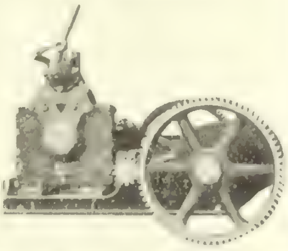

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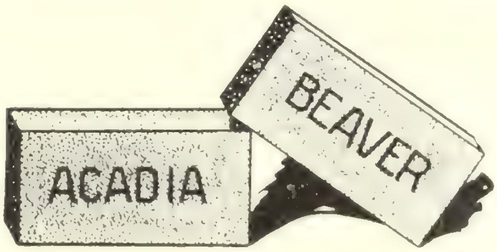

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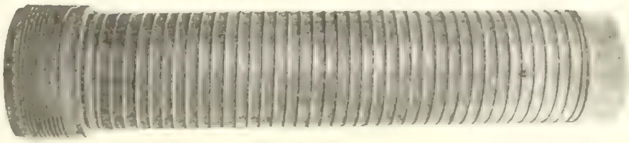

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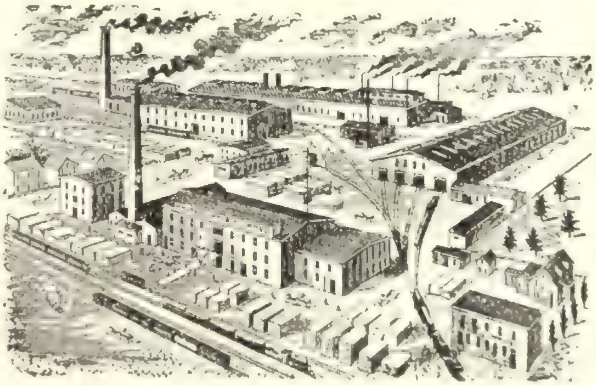

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Current Prices of Building and Engineering Materials

CEMENT, LIME, AND BRICK

Toronto prices (wholesale) delivered:

Cement—delivered in 5 barrel lots, $1.85 per bbl.; car lots, $1.55. Bags extra.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red and buff brick, $18; common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick (a) $8.10, King Edward siding, (b) $10.50 delivered on the job. paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18. Brick 2½ x 4 x 8¼ in.; blocks 3½ x 4 x 8½ in.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

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Toronto prices, delivered on the job:

Steel—(round and square bars) $2.10, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

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Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

The Co-Operative Builders & Supply Company of Sherbrooke, Que., have dissolved. Mr. Wilfrid W. Davey has taken over the business.

Messrs. William Roberts and Horace Francis Swift have been registered as Swift & Roberts, contractors and foundry supplies, Montreal, P.Q.

In the period 1905 to 1907, Calgary's building permits totalled $4,030,229. During the next three years this was more than doubled, amounting to $9,637,136. But it was in the next thirty-six months that such great development took place. From January 1, 1911, until December 31, 1913,—three years—the building permits reached the considerable sum of $41,921,958.

The firm of Thompson, Daniel & Colthurst, which has practised in the architectural line in Saskatoon for the past two or three years, has been dissolved by mutual consent. T. B. Daniel and G. Buller Colthurst have arranged a partnership. The new firm will be known as Daniel & Colthurst, and will continue to conduct business from the present offices of the late firm, in Central Chambers, Saskatoon.

A Bill has been introduced in the Nova Scotia Legislature to provide for the completion of the St. John Valley Railway. According to original plans the road will come into St. John by the eastern route across the St. John and Kennebacasis Rivers. To make this possible the Dominion Government has agreed to provide the cost of the larger bridges, which will entail an outlay of $3,000,000. An additional bond guarantee of $10,000 a mile for the entire length of the road is to be provided.

Dr. J. W. McCullough, Secretary of the Provincial Board of Health, recently had a conference with the members of the Orillia Town Council and the Water, Light & Power Commission, in the course of which he urged the installation of a filtration plant, basing his argument for filtration chiefly on the analysis of Orillia water during the past year and on Dr. Amyot's report regarding the sources of supply. Plans, based upon the Provincial Board's requirements of a receiving basin for the chemical treatment of water before filtration, have been prepared and will be submitted to the Provincial Board of Health, upon the approval of which the Commission will apply to the council to provide the necessary money.

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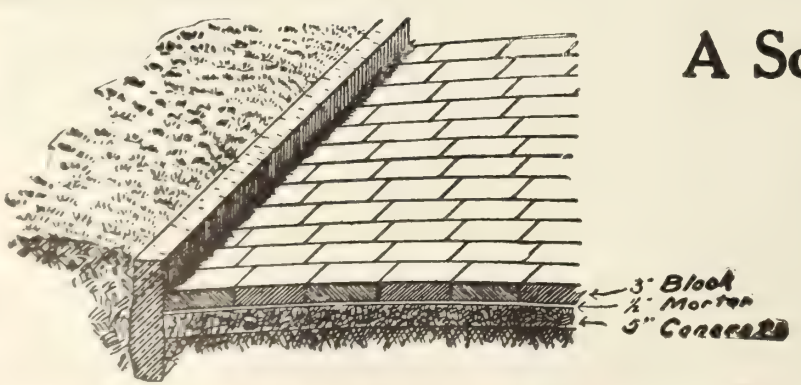

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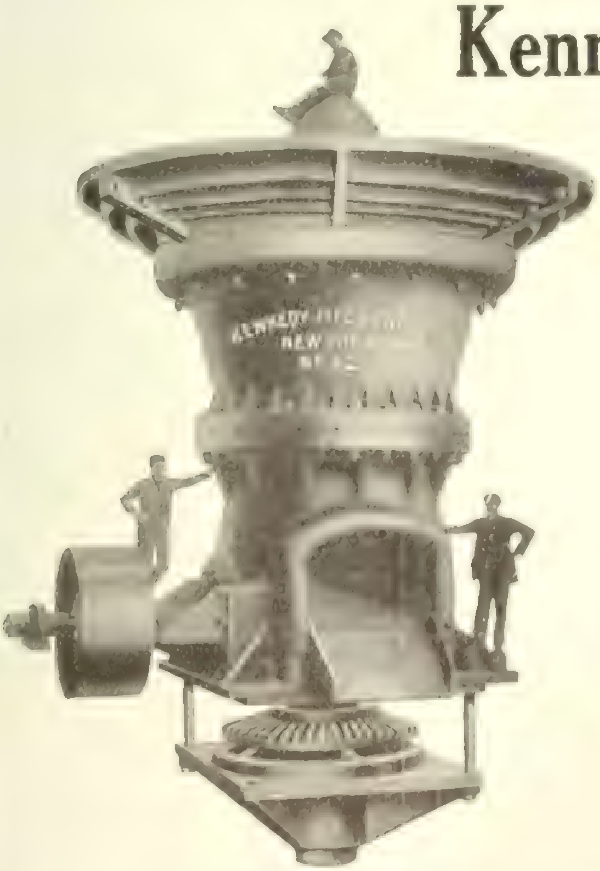

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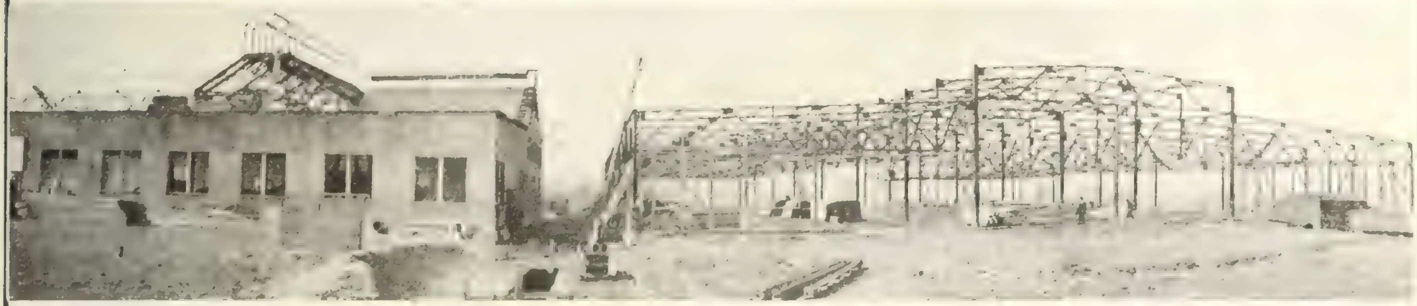

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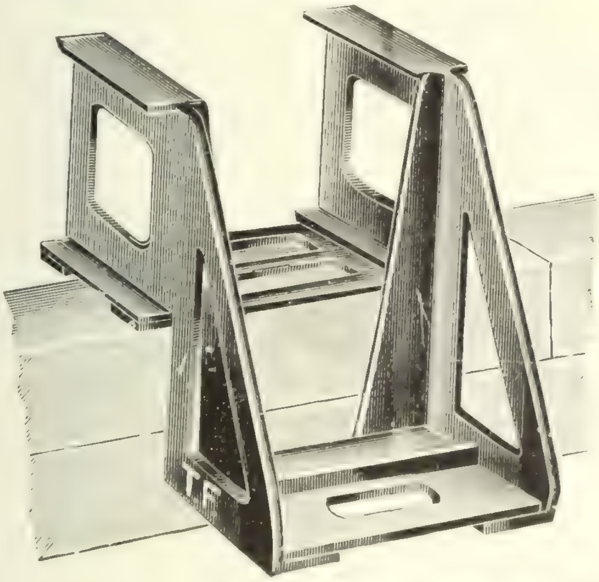

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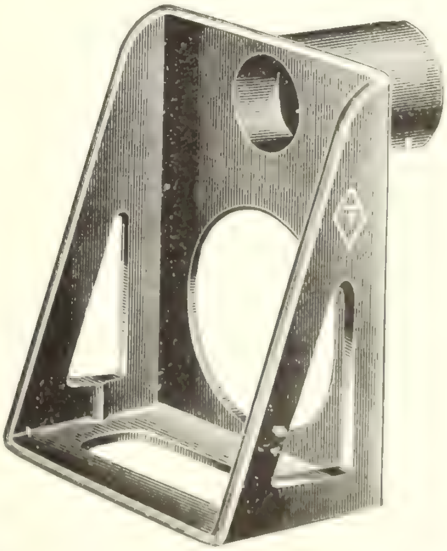

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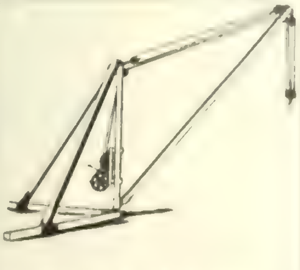

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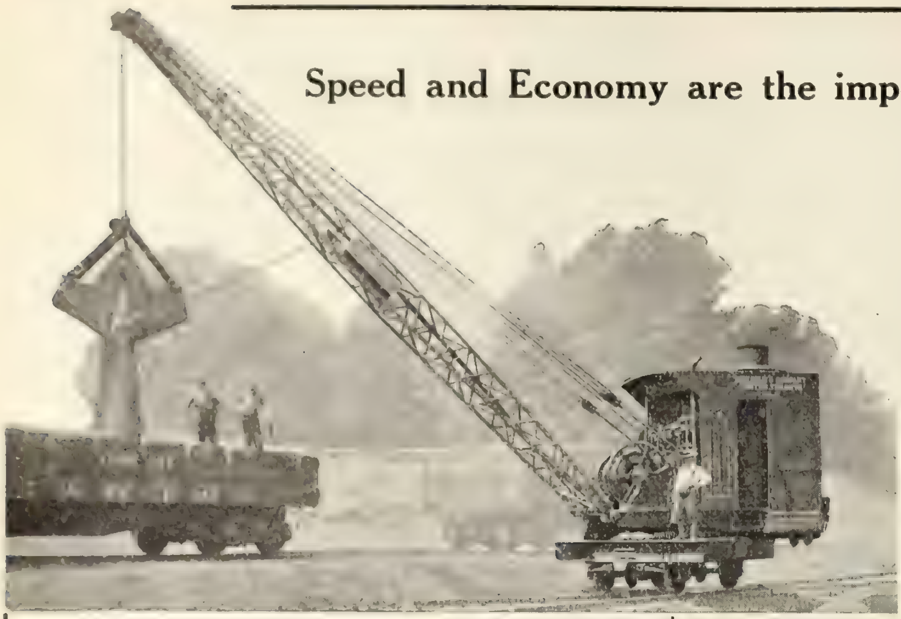

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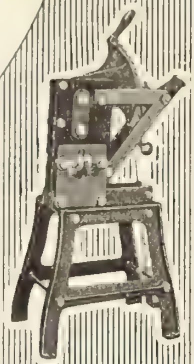

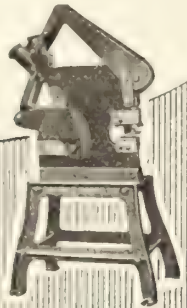

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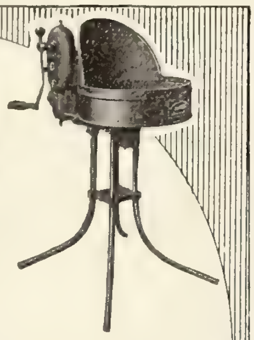

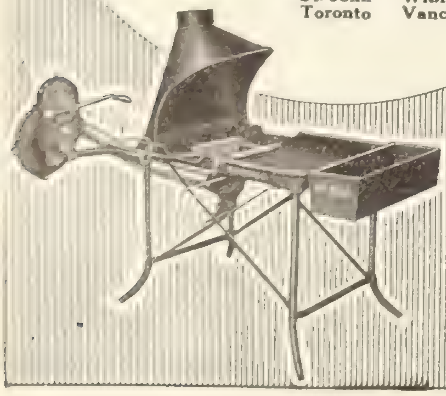

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Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price $1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00.

Engineering as a Vocation, by Ernest McCullough. Published in 1911 by David Williams Company, New York. 200 pages. Price 50c.

The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons. 102 pages. Illustrated. Price 50c.

Reinforced Concrete, by Charles S. Hill. Published in 1906 by The Engineering News Publishing Company, New York. 498 pages. Illustrated. Price $2.00.

Book Department

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220 King Street West - Toronto, Canada

Block Stone, Dimensions, Random, Head Sills, Shoddy, Stone Sawing

Sackville Freestone Co., Limited, Sackville, N. B.

WRITE US FOR QUOTATIONS

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Third of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

THE McARTHUR BUILDING, WINNIPEG

This building was wired with "30% PARA" Rubber Insulated Wire.

Architect: J. H. G. Russell, Winnipeg
Engineer: Charles L. Pillsbury, Minneapolis, Minn.
Electrical Contractors: Mitchell, Gray, Electric Co., Winnipeg.

Address our nearest office

Northern Electric Company
LIMITED

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Halifax
Toronto
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Regina
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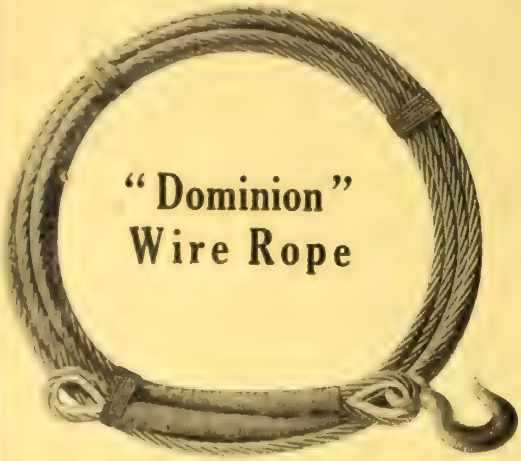
Successors to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C P R Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto and 599 Henry Ave., Winnipeg.



WIRE ROPE

Suitable for any requirement

We carry in stock all sizes and lengths wire rope for

Hoisting, Haulage, Guys, Semaphores, Transmission of Power, Towing, Bridges, Mines, Derricks, Cranes, Cableways, Coal Towers, Etc.

We manufacture special ropes to take care of your particular needs.

WIRE ROPE FITTINGS, BLOCKS, CLIPS, ETC. IN STOCK

The Dominion WIRE ROPE Co. Ltd.
MONTREAL

"Industrial Works"
Locomotive-Coaling and Wrecking

CRANES

In capacities from
5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

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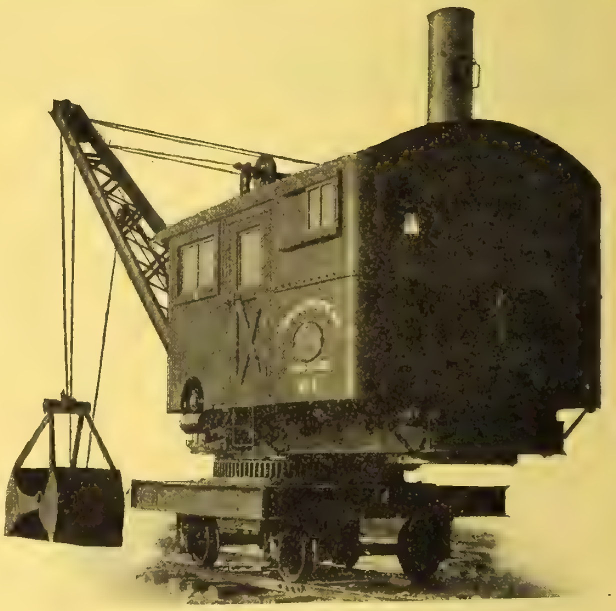
For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

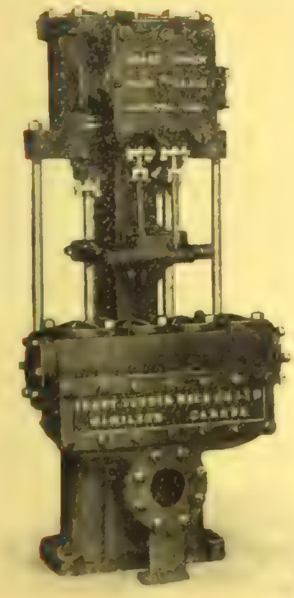
F. H. HOPKINS & CO., HEAD OFFICE **MONTREAL**

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, May 6, 1914 No. 18

ESTABLISHED 1886

Contract Record and Engineering Review



Why Not Buy the Best

when in the market for

PUMPING MACHINERY?

Stock of pumps carried by
General Supply Co. of Canada,
Winnipeg, Man.

The Smart-Turner Machine Co., Ltd.
HAMILTON, ONT.

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

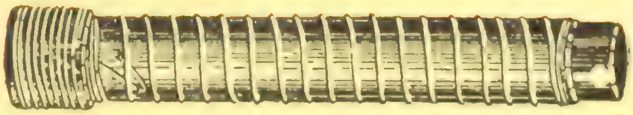
The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

Air Compressors
OF BELLISS MAKE
have gained their reputation for

Simplicity of Design
Noiseless Running
Compact Design
Low Oil Consumption
Continuous Operation
Overall Efficiency

Messrs. Belliss & Morcom, Ltd.
BIRMINGHAM, ENGLAND

Agents
Laurie & Lamb
Board of Trade Building, MONTREAL



Continuous and Machine Banded Wood Stave

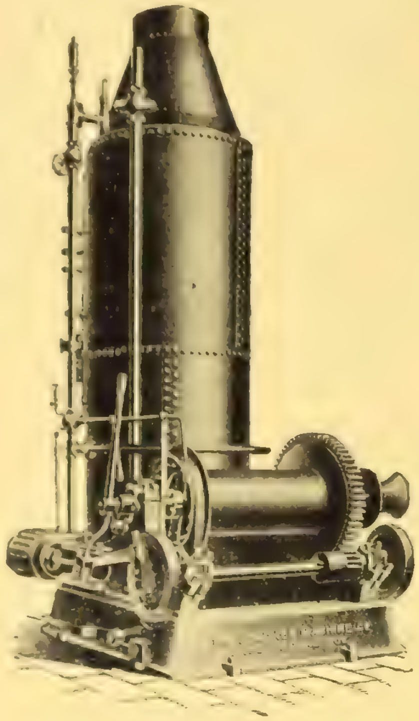
WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6



Hoisting Engines

¶ To the Contractor who wants a good reliable and efficient hoisting engine,—one that will always be right on the job—we suggest an inquiry into our wide range of this type of machine.

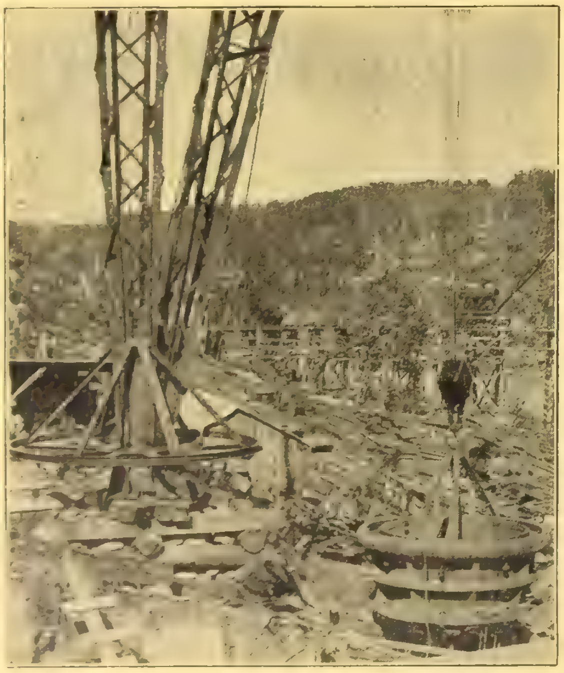
Any one of our offices will help you find the engine best suited to your needs.

The JENCKES MACHINE COMPANY, Limited

General Offices: SHERBROOKE, QUE.

Works: Sherbrooke, Que. St. Catharines, Ont.

Sales Offices: Sherbrooke, St. Catharines, Nelson, B.C. Vancouver, Montreal, Cobalt, S. Porcupine



One man takes a chance, that's gambling; another buys "AMERICAN" Steel Derricks, that's good business, which is nothing but sound common sense.

Every possible stress and strain is covered by the carefully calculated and proportioned construction of these derricks.

An "AMERICAN" Fifty-Ton Steel Guy Derrick

is shown here working on the Hardaway Contracting Company's big hydro-electric power construction at Whitney, N.C. It is lifting a 96,000 pound casting of a Gates crusher. This derrick has a monster 5 sheave block—as tall as a man.

Greatest safety, longest service—You get them both when you buy "AMERICAN" Steel Derricks.

MADE BY

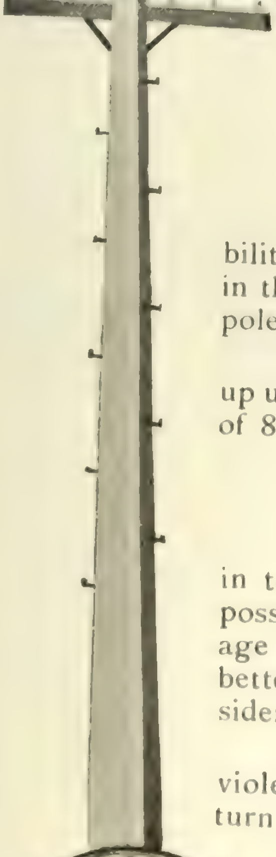
American Hoist & Derrick Company

ST. PAUL, MINN., U. S. A.

SOLD BY

General Supply Co. of Canada, Ltd., Montreal, Ottawa, Toronto.
Stuart Machinery Co., Winnipeg, Man.
Vancouver Machinery Depot, Ltd., Vancouver, B. C.
Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

Concrete poles along the Pennsylvania Railroad across the Hackensack, Meadows New Jersey.



Concrete Poles Withstand Terrific February Blizzard

One of the most striking examples of the durability and stability of poles carrying telegraph and service wires, is that contained in the performance of the Pennsylvania Railroad's line of concrete poles across the Hackensack Meadows during the February blizzard.

These poles are badly exposed from all sides, but they stood up under a great weight of snow and ice and resisted a wind velocity of 80 miles an hour.

Municipalities and corporations wishing to

Minimize "Service Breaks"

in telegraph, telephone and service lines should investigate the possibilities of concrete poles. They not only gain strength with age but they do not rot or rust. No other type of pole will keep better alignment. They are not prohibitive in first cost and, considered as a long time investment, are exceedingly economical.

The cost of "broken service" and the repairs necessary after one violent storm would equip an entire line with Concrete poles which, in turn, would serve to prevent a great many future "breaks in service."

Full information about Concrete poles will be sent free to those interested, upon request.

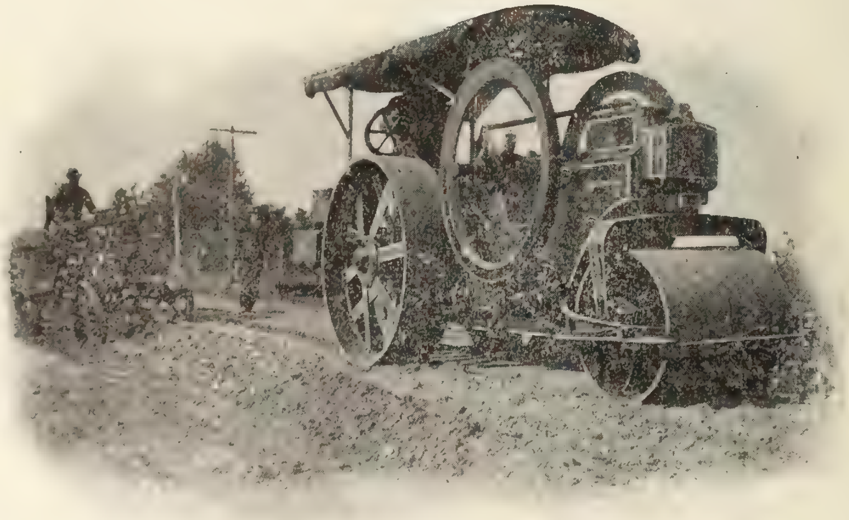
Information Bureau

Canada Cement Company
Limited
888 Herald Building, Montreal

Do Not Buy Your Road Roller

until you have investigated the qualities of the

Austin Motor Road Roller



Made
in
Five
Sizes

Efficient
and
Economical

Will do everything required of a roller—Easily controlled—Anyone can operate it—Low operating cost—Only using fuel when in actual operation—No soot, smoke or sparks blowing about—Can be operated by Gasoline, Kerosene, Distillate or Denaturized Alcohol.

See our Motor Roller on exhibit at the Montreal Good Roads Congress May 18th to 23rd.

Mussens Limited

MONTREAL 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT Opp. Right of Way Mine

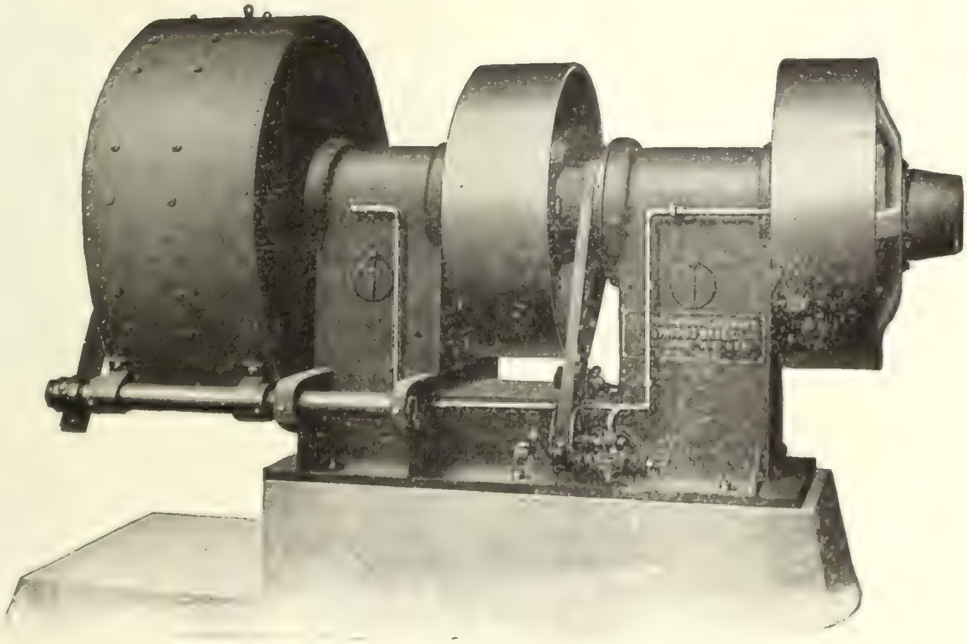
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.

QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

The Greatest Recrusher

The **Symons Disc Crusher**

Excels in Economy of Power
in Uniformity of Product
in Low Repair Cost



Capacities ranging from 40 tons of quarter inch to 1000 tons of two and a half inch per 10 hour day.

It is the only Crusher which will take rejections, screened or unscreened, from Standard Gyratory Crushers and reduce same rapidly at one operation to ¾ inch size and less.

Catalogue on Request

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.

QUEBEC, 31 St. Louis St.
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- Nova Scotia Clay Works
- Russell Shale Bricks
- Sydney Pressed Brick Co.
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(Continued on page)

Announcement

Now You Can Buy a

Cement Gun

The Cement-Gun has established itself. It has been successfully used on enough jobs of sufficient variety of character to demonstrate its efficiency beyond question.

This Company will sell the Cement-Gun outright for use in Dominion of Canada, or lease it if the amount of work does not justify its purchase.

The Cement-Gun has been used for over three years on the most important engineering work.

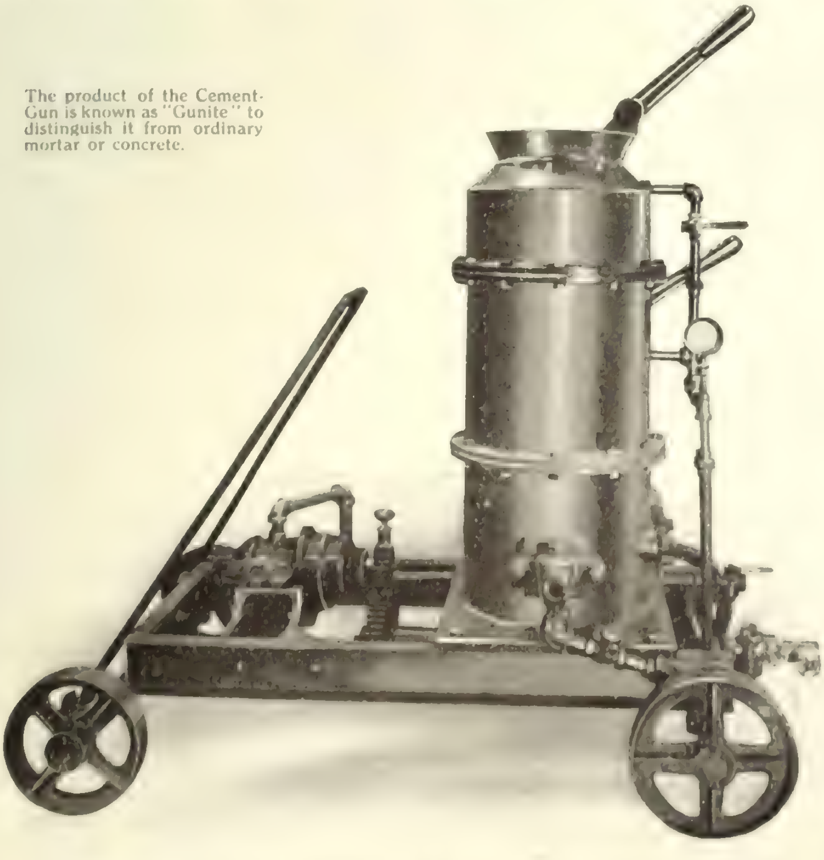
In several instances, where no other method or device could succeed the Cement-Gun has proved remarkably successful.

We shall be glad to mail you Bulletins not only describing the machine itself, but going into detail regarding the work it has accomplished, illustrated with photographs. Please write for these Bulletins.

This is how it goes on

Cement-Gun Company; Inc.
30 Church Street, New York City
Exclusive Sales Agents for Dominion of Canada

The product of the Cement-Gun is known as "Gunite" to distinguish it from ordinary mortar or concrete.



TWO NOZZLE CEMENT GUN, TYPE G-1, 1913 MODEL
(In this illustration the Cement-Gun is shown without the cover over the motor and gears.)

Important Work Accomplished with the Cement-Gun

1. Giving structural steel a protective rust-proof and fire-proof coating without the use of forms—
   - **Grand Central Terminal Improvements, and Woolworth Building Columns, New York; Calvert St. Bridge, Baltimore, Md., etc., etc.**
2. Lining tunnels, dry walls, irrigation ditches, etc., with a water-proof protective coating—
   - **Water Dept., Baltimore, Md., at Lock Raven, Md.**
   - **Hawaiian Ditches and Tunnels, etc.**
3. Coating Wood piles to protect them from Teredos, Limnoria and other destructive sea insects—
   - **The San Juan Bulkhead, Porto Rico, and along the Pacific Coast.**
4. Waterproofing Concrete Dams—
   - **Twin Peaks Reservoir, San Francisco, etc.**
5. Repairing Defective Concrete Sea Wall—
   - **At Lynn, Mass., Fort Slocum, N. Y., etc.**
   - **Refacing Locks of Welland Canal.**

And Coating Frame Houses, Factory curtain and inclosing walls, Inside Plastering with Lime Mortar, with Cement Mortar, Waterproofing, etc., etc

A Highway Engineer Reduced His Hauling Costs

In the Engineering Record for December 6th, there is a very interesting article on "Highway Improvements in North Alabama," by P. S. Fitzgerald, highway engineer for Lawrence County, Alabama. We will repeat what Mr. Fitzgerald says about his hauling outfit:

"The haul here is in most cases short; 2 miles is the maximum. The Rumley, 'Oil Pull' tractor and

TROY

Reversible Wagons

on long hauls reduce the cost of hauling to about 10 cents per yard-mile compared with 25 to 35 cents per yard-mile with teams; although where three teams at $3.00 per day will haul all the stone crushed there is no economy in the tractor and reversibles. It costs little, however, to keep the hauling outfit in readiness, and its moral effect on the price of hired teams is very marked; for here as everywhere, team owners charge 'all the traffic will bear' —and generally strike for higher pay whenever the necessity for using them seems greatest.

The tractor used is small, pulling four 3-yard wagons and frequently has made 100 yard-miles daily at an expense of less than $10.00 besides spreading and leveling the crushed stone with an ordinary road machine or grader attached to the rear of the train. Good teams haul 1½ cu. yd. per load and if watched make ten to twelve round trips daily on a one-mile haul. The limit of a good day's work at macadamizing is the performance of the slowest machine from crushing to rolling. Thus far the county has found one mile in average weather a good month's work for one plant.

If you have any kind of a hauling job now, or think you may have some day you ought to have our Hauling Book 2R. It tells why and how more than 250 different Troy Trains of Reversibles (a few of which are illustrated here) have each more than cut their owner's hauling costs in half. It discusses fully and frankly the hauling question. We'll be glad to send it to you.

The Troy Wagon Works Co.

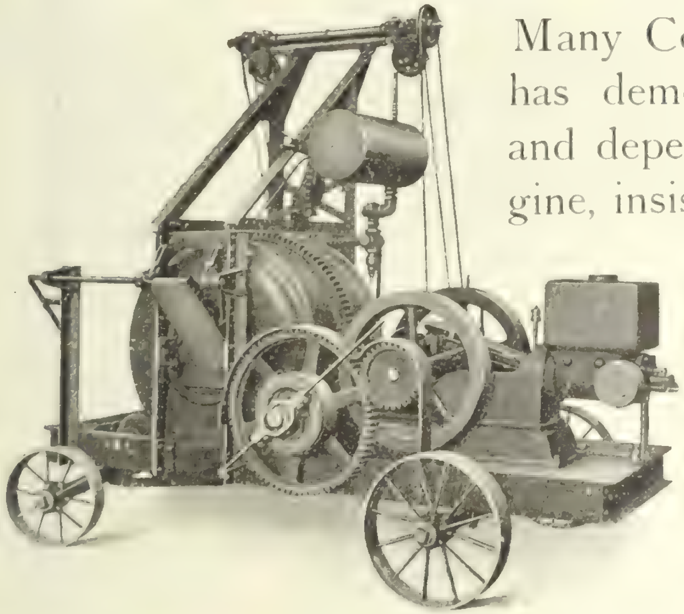
N. Market St. **TROY, OHIO**

DISTRIBUTORS;

G. C. Hodges, Brooklyn.
Standard Supply & Equipment Company, Philadelphia.
Henry H. Meyer & Company, Baltimore.
H. H. Hoover, Pittsburgh.
W. S. Brown & Sons, Birmingham.
A. Baldwin & Company, New Orleans.
South Texas Implement Company, Houston.
W. M. Pattison Supply Company, Cleveland.
Hudson-Feenaughty Co., Portland.
E. R. Bacon & Company, San Francisco
W. L. Cleveland & Company, Los Angeles.
Landes & Company, Salt Lake City.
Western Metal Manufacturing Company, El Paso.
N. J. Dinnen & Company, Winnipeg.
Canadian Equipment & Supply Company, Calgary.
C. Paquet & Company, Quebec.
W. McNally & Company, Montreal.

Take a Good Look at this Gasoline Driven

M-C Rail Track Mixer



Many Contractors, since the automobile has demonstrated the positive, reliable and dependable power of the gasoline engine, insist on gasoline-driven mixers.

This demand is met by the

M-C RAIL TRACK MIXER

mounted on trucks with Elevating Side Loader and Automatic Water Measuring Tank; operated by Gasoline Engine in Steel House.

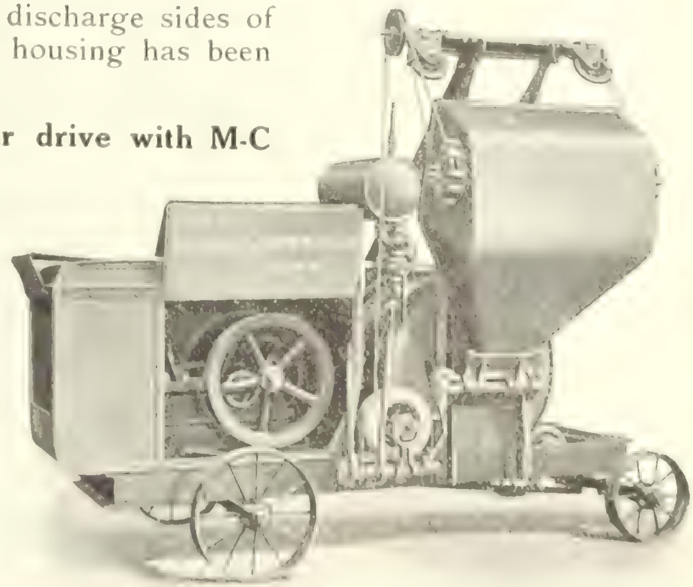
The two views here show the charge and discharge sides of the machine. In the upper view the steel housing has been removed to show the engine.

A feature of this outfit is the **spur gear drive with M-C Friction Clutch** so engine may be started without turning mixer.

This mixer is built in **five sizes,** with capacities of ¼, ⅓, ½, ¾ and 1 cu. yd. of concrete per batch.

The **gasoline engines** are 5, 6, 8 and 10 H.P.; hopper cooled, gasoline supply carried in base of engine.

The mixer illustrated is one of our most popular outfits. **It is highly recommended by us and carries our absolute guarantee.**



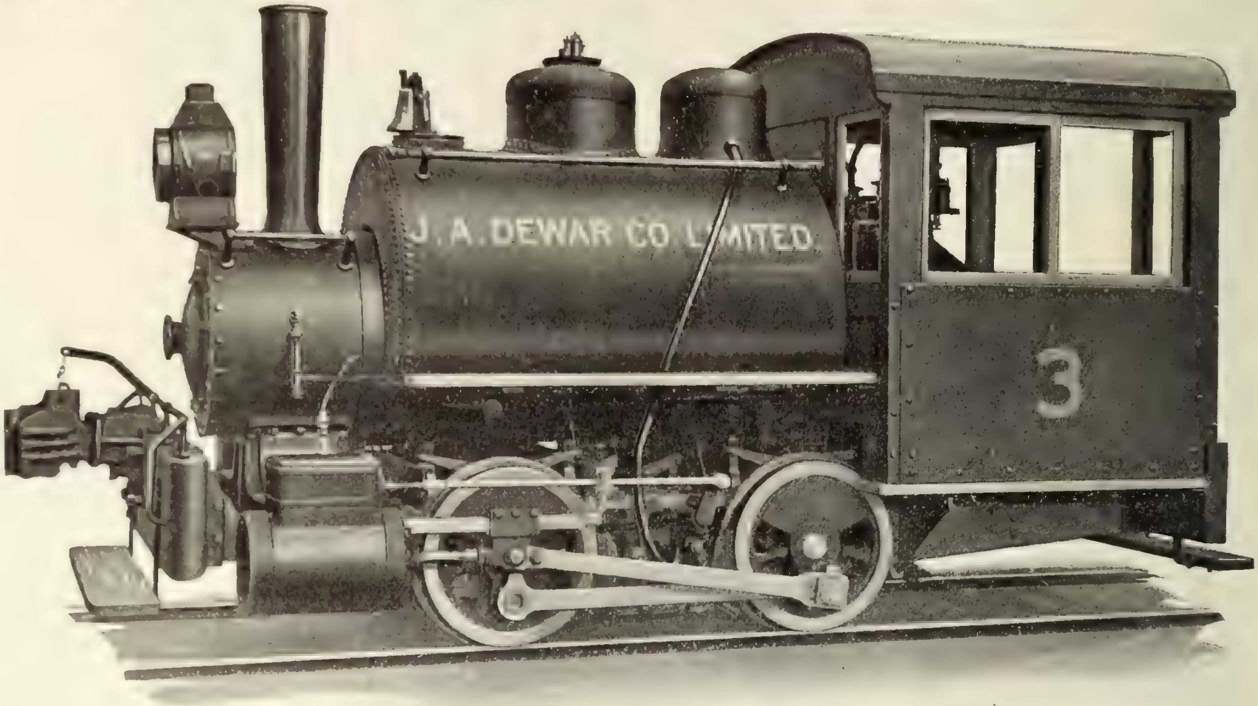
CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver

Manufactured by

Marsh-Capron Mfg. Company
467 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



This engine is 10" x 14" and weighs 15 tons.

FIFTY YEARS EXPERIENCE AS BUILDERS CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names in Mind when Ordering High Grade Brick.

Beaver Clay Mfg. Co.

Columbus Brick and Terra Cotta Co.

Hydraulic-Press Brick Co.

Hocking Valley Fire Clay Co.

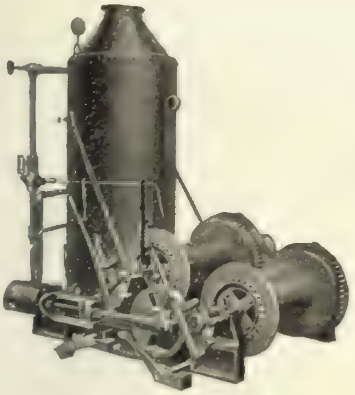
Kushequa Brick Co.

Ohio Mining & Mfg. Co.

Pearl Clay Products Co.

Tiffany Enameled Brick Co.

BLACK BUILDING SUPPLY CO., LTD. - TORONTO


Standard Hoisting Engine

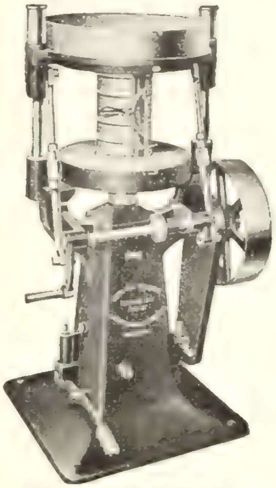
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D. McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Fort William, Ont.—Northern Eng. & Supply Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada


Dunn Cement Drain Tile Machine

Concrete Mixers

—

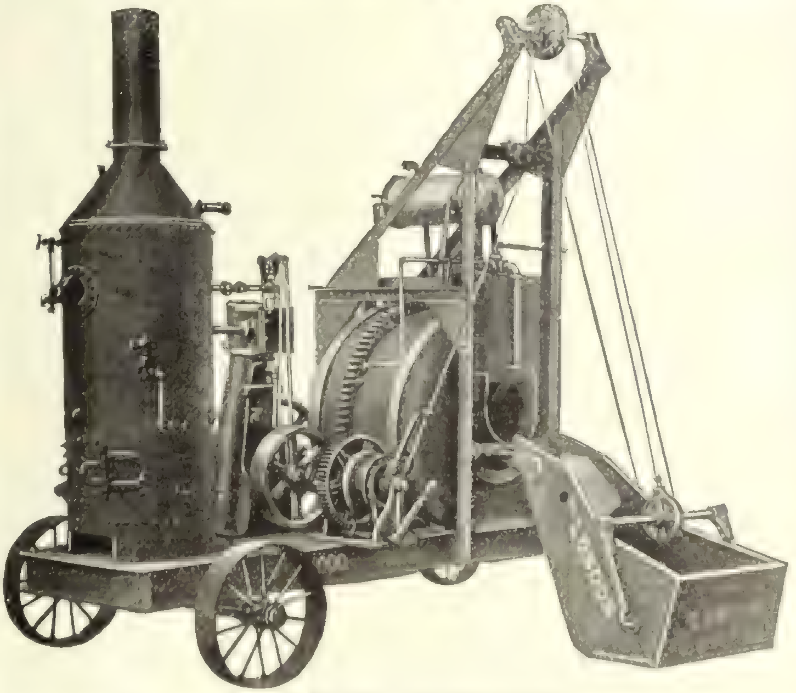
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines


London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

—

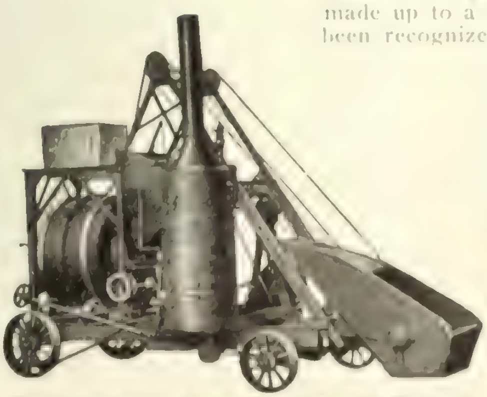
Pumping Outfits

—

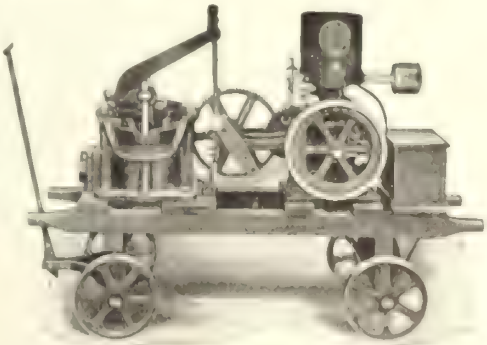
Hoists and Derricks

Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.


Rear Discharge Paving Machine with Forward Loader

Correspondence Solicited.


Diaphragm Pump with Power

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Dump Cars, Wheels, etc.
  Beatties Limited
  Manitoba Bridge & Iron Works.
  Sorel Foundry & Machine Co.
  Western Wheeled Scraper Co.
  Weller Mfg. Co.
  Sheldons Limited.

Dump Carts and Wagons
  Deere Plow Co., John.
  Troy Wagon Works

Drying Apparatus
  Sturtevant Co. of Can. Ltd. B. F.

Electric Fans
  Sturtevant Co. of Can. Ltd. B. F.

Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electric Steel Castings
  Electric Steel & Metals Co.

Elevators
  Roelofson Elevator Works.

Enamelled Brick
  American Enamelled Brick & Tile Company
  National Builders' Supply & Enamel Concrete Brick Co.

Engines
  Boving Company of Canada
  Canadian Buffalo Forge Co.
  Canadian Sirocco Co.
  Inglis Co., John
  Jenckes Machine Co.
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks.
  Mussens Limited
  Rock & Power Machinery
  Waterous Engine Works Co.
  Wettlaufer Bros.

Engineers (Civil and Mechanical)
  Bowman & Connor
  Campbell, R.
  Chipman & Power
  Dominion Engineering & Inspection Company.
  Farmer, John T.
  Galt Engineering Co., John
  Lea & Ferguson
  Mitchell, C. H.
  Thorold Co., F. W.
  Tyrrell, H. G.

Excavators
  Austin Drainage Excavator Company, F. C.
  Brown Hoisting Machinery Co.
  Municipal Engineering & Contracting Company.
  Parsons Company, G. W.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Expansion Bolts
  Star Expansion Bolt Co.

Expanded Metal
  Mannesmann Tube Co.
  Pedlar People Limited.

Fans
  Canadian Sirocco Co.
  Sheldons Limited.
  Sturtevant Co. of Can. Ltd. B. F.

Fuel Economizers
  Sturtevant Co. of Can. Ltd. B. F.

Electrical Machinery and Supplies
  Ferranti Electrical Co.
  Sturtevant Co. of Can. Ltd. B. F.

Field Instruments
  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Fire Brick
  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works.
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry.
  Mussens Limited
  Pedlar People Limited.
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Fixtures (Gas)
  Consumers Gas Co.

Folding Doors
  Springer, O. T.

Forges
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

Gas Engines
  Armstrong Mfg. Co.
  British Mfrs. Assn. of Canada.

Gasoline Engines
  Armstrong Mfg. Co.
  Original Gas Engine Co.
  Wettlaufer Bros.

Glass
  Consolidated Glass Co.
  Excelsior Plate Glass Co.
  Hobbs Mfg. Co.
  Luxfer Prism Co.
  Toronto Plate Glass Imp't'g Co.

Gravel Washing Plants
  Dull Co., Raymond W.

Hammer Drills
  Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Escher Wyss & Co.
  Mannesmann Tube Company.
  Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Fairbanks-Morse Co.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
  Marsh & Henthorn
  Morris Hoist & Crane Co., Hbert.
  Mussens Limited
  Rock & Power Machinery
  Royce Limited
  Sturtevant Co. of Can. Ltd., B. F.

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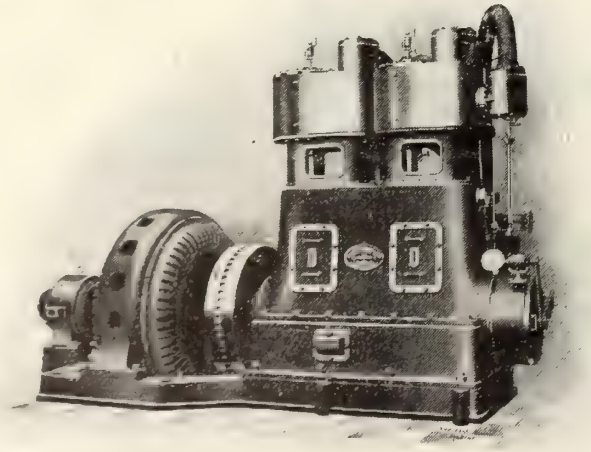
BRUCE PEEBLES



Peebles-Browett Alternator Set

Alternators and Generators

are built suitable for belt-drive or for direct coupling to any form of prime mover.

Send Us Your Enquiries

The Ferranti Electrical Co. of Canada, Ltd.

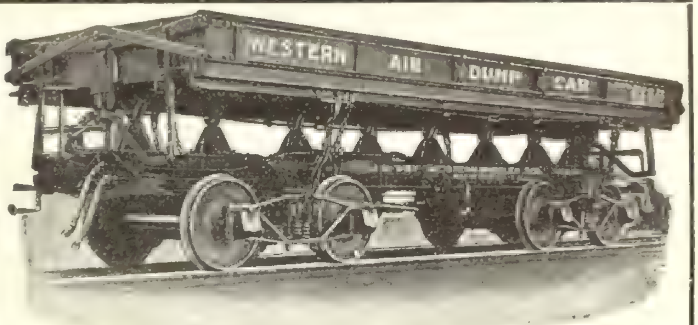
90 Sherbourne St., TORONTO
Farmers' Advocate Building, Cor. Notre Dame & Langside, WINNIPEG

If you are not using

"ABRAM" TOOLS

It is plain to be seen you are losing money

Abram Cement Tool Co.,
Windsor, Ontario



WESTERN DUMP CARS

constitute the most modern means for receiving, transporting and depositing earth, stone or other material.

The Western car is ahead of all other dump cars in points of economical operation, quality of material used, freedom from derailment, durability and superiority of mechanical design in general.

Strong endorsement of these claims was furnished by the engineers in charge of the Panama Canal when they selected Western Dump Cars for handling material during excavating operations.

Illustrated catalogue containing full technical information on request.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited

Hoists
Roelofson Elevator Works
Northern Crane Works.
[illegible] Mfg. Company

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Wettlaufer Bros.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

Insulating Compounds
Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
Batts Limited
Canada Office & School Fur. Co.
Rhodes Curry & Co.

Jib Cranes (all kinds)
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

Kilns
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
Canadian Sirocco Co.
Berg Machinery Mfg. Co.

Lime
Dominion Lime Company.
Jamieson Lime Co.
Ontario Lime Co., Ltd.
Standard White Lime Co.

Lighting and Pumping Installations
Lister & Co., Ltd., R. A.

Locks
Can. Yale & Towne Ltd.

Locomotives
Boving Company of Canada
Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Co.
Mussens Limited

Metal (Anti-Corrosive)
Stark Rolling Mill Co.

Metal Lath
Greening Wire Co., B.
Metallic Roofing Co.
Noble, C. W.
Pedlar People Limited.
Steel & Radiation Ltd

Meters, Electrical
Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd.

Mechanical Draft Apparatus
Sturtevant Co. of Can. Ltd. B. F.

Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
Neptune Meter Co.

Overhead Runways
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

Paints and Varnishes
Dominion Paint Works
Hopkins & Co., F. H.

Paving and Paving Materials
Asphalt & Supply Co.
Aztec Oil Asphalt Co
Baker Co., R. D.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

Pipe (Concrete, Iron and Wood)
American Spiral Pipe Works
Canadian Allis-Chalmers, Ltd.
Canadian Pipe Co.
Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
Gerald Lomer, Ltd.
Mannesmann Tube Company.
National Concrete Mfg. Co.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
Steffens & Nolle
United States Cast Iron Pipe Co
Vancouver Wood Pipe & Tank Company.
Walsh Plate & Structural Works.

Partition Hangers
Springer, O. T.

Paints (Bridge and Structural Iron and Pipe Coating)
Dominion Paint Works

Perforated Metals
Canada Wire & Iron Goods Co.
Greening Wire Co., B.

Pipe Machinery
Sutcliffe, Speakman & Co.

Pile Driving Machinery
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Pipe Fittings and Flanges
Pittsburgh Valve, Foundry & Construction Company

Plumbing Supplies
Mueller Mfg. Co., H.

Planing Mill Exhausters
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.

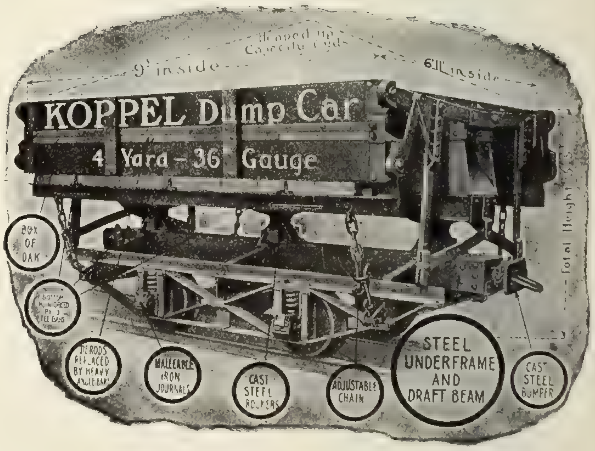
Plaster
Alabastine Hardmortar Co.
Albert Mfg. Company
Britnell & Company
Ontario Lime Co., Ltd.

Plate Glass
Excelsior Plate Glass Co.
Pilkington Bros.

(Continued on page 16)

What Big Contractors

Say About This Koppel Car



Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.

Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Storage Bins, Capacity 2000 Tons

Crushed Stone

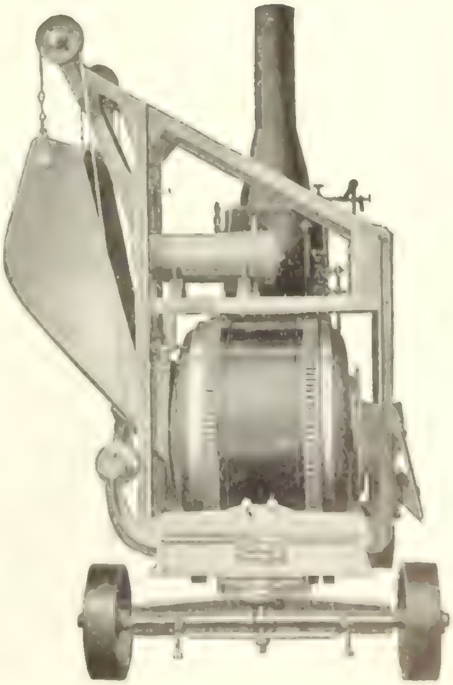
All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario



NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Plumbing
Dietrich Limited

Pneumatic Machinery
Canadian Ingersoll Rand Co.

Pumps and Pumping Machinery
Beatty & Sons, M.
Boving Company of Canada
British Mfrs. Assn. of Canada.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
Cook, A. D.
Gray Mfg. & Machine Co.
Hamilton Mfg. Co., Wm.
Honig & Mock.
Inglis & Company, John
McDougall Caledonian Iron Wks.
Morris Machine Works.
Smart-Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Rock & Power Machinery
Wettlaufer Bros.

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Portable Track
Bechtels Limited

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Inglis Company, John
Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.
Waterous Engine Works

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Improved Equipment Co.
Lecky & Collis
George Anderson & Co.
Goodwin, Barsby & Company.
Rock & Power Machinery, Ltd.

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Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

Reinforcements, Concrete & Steel
Brown Hoisting Machinery Co.
Burlington Steel Company
Canada Wire & Iron Goods Co.
Dominion Iron & Steel Co.
Greening Wire Co., B.
Pedlar People Limited.
Steel & Radiation Ltd.
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H. R. Heinicke Inc

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Barber Asphalt Paving Co.

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General Car & Mach. Works
Lecky & Collis
Morrison & Co., T. A.
Mussens Limited
Waterous Engine Works Co.
Western Wheeled Scraper Co.

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Goodwin, Barsby & Company.
Greening Wire Co., B.

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Hope & Sons, Henry.

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Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.
Pedlar People Limited.

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Canadian Fairbanks-Morse Co.

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Goodwin, Barsby & Company.
Greening Wire Mfg. Co., B.
Weller Mfg. Co.

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British Mfrs. Assn. of Canada.

Sewer Pipe
Britnell & Company
Canada Iron Corporation
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sewer Trenching
Lecky & Collis

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Montreal Locomotive Works
Mussens Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co.

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Hope & Sons, Henry

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DesMoines Bridge & Iron Co.
Hamilton Mfg. Co., Wm.
Manitoba Bridge & Iron Works.
Pittsburgh-DesMoines Steel Co.
Walsh Plate & Structural Works

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Pittsburgh Valve, Foundry and
Construction Company
Sheldons Limited

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Gray Mfg. & Machine Co.

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Gray Mfg. & Machine Co.

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McDougall Caledonian Iron Wks.
Sturtevant Co. of Can. Ltd. B. F.

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Dominion Iron & Steel Co.
Steel & Radiation, Ltd.

Steel
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Can. Billings & Spencer
Lecky & Collis

Steel Pipe
Gerald Lomer, Limited
Mannesmann Tube Company.
Steffens & Nolle

Steel Tubes
Mannesmann Tube Co.

Sound Deadening
Cabot, Inc., Samuel

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Cabot, Inc., Samuel

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Electric Steel & Metals Co.

Steel Sash
Hope & Sons, Henry.

Steel Sheet Piling
Drury Company, H. A.

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Britnell & Company
Brodie, James
Consolidated Stone Company
Contractors' Supply Company
Crushed Stone, Limited
Hagersville Contracting Co.
Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Parsons Company, G. W.
Queenstown Quarry Co.
Rogers Supply Company
Sackville Freestone Company
Sand & Supplies
Smyth & Ryan

Stone Saws
Anderson, Geo.

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Zouri Drawn Metals Co.

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Burlington Steel Company
Canadian Allis-Chalmers, Ltd.
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Dominion Bridge Company
Drury Company, H. A.
Hamilton Bridge Works Co.
Mackinnon Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
McGregor & McIntyre
Pittsburgh-DesMoines Steel Co.
Reid & Brown
Sarnia Bridge Company
Structural Steel Company
Standard Steel Construction Co.
Toronto Structural Steel Co.
Walsh Plate & Structural Works

Submarine Drills
Lecky & Collis

Swinging Gears
Dake Engine Company

Tanks and Stand Pipes
Chicago Bridge & Iron Works
Hamilton Mfg. Co., Wm.
Inglis, John
Jenckes Machine Co.
Manitoba Bridge & Iron Works.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
Ontario Wind Eng. & Pump Co.
Piggott & Co., Thos.
Pittsburgh-DesMoines Steel Co.
Vancouver Wood Pipe & Tank
Company.
Walsh Plate and Structural Wks.
Waterous Engine Works Co.

Terra Cotta
Northwestern Terra Cotta Co.

Testing and Inspecting Bureau
Hunt & Co., Robt. W.

Tile Machinery
Sutcliffe, Speakman & Co.

Track Systems (Hand, Power and Electric)
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

Traction and Lighting Poles
Mannesmann Tube. Co.

Turnbuckles
Canadian Billings & Spencer, Ltd.

Underground Conduit
Dietrich Limited

Valves
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Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Golden Anderson Valve Co.
Kerr Engine Company
Pittsburgh Valve, Foundry &
Construction Company

Ventilating & Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Company
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.
Wilson, Limited, John T.

Vacuum Cleaners
Tuec Company

Varnish
Dougall Varnish Co.

Varnishes—Insulating
Standard Underground Cable Co.
of Canada, Ltd.

Wall and Joist Hangers
Taylor Forbes Company

Wall Board
Bird & Son

Waterproofing
Cabot Inc., Samuel
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Ceresit Waterproofing Co.
Wadsworth Howland & Co., Inc.

Water Softeners and Filters
American Water Softener Co.
Equipment & Supplies, Limited.
Manitoba Bridge & Iron Works.

Water Tapping Machine
Mueller Mfg. Co., H.

Water Turbines
Canadian Allis-Chalmers, Ltd.
Boving Company of Canada
Escher Wyss & Co.
Hamilton Mfg. Co., Wm.
McDougall Caledonian Iron Wks.

Well Drilling Machinery
Armstrong Manufacturing Co.

Wire Glass
Pilkington Bros.

Wires and Cables
Canada Wire & Cable Co.
Northern Electric Co.
Standard Underground Cable Co.
of Canada, Limited

Wire Guards and Screens
Canada Wire & Iron Goods Co.
Greening Wire Co., B.

Wire Rope
Canada Wire & Cable Co.
Greening Wire Co., B.

Wrenches
Canadian Billings & Spencer, Ltd.

Wrenches
Can. Billings & Spencer, Ltd.

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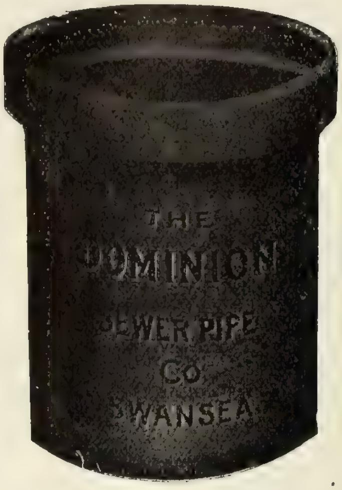

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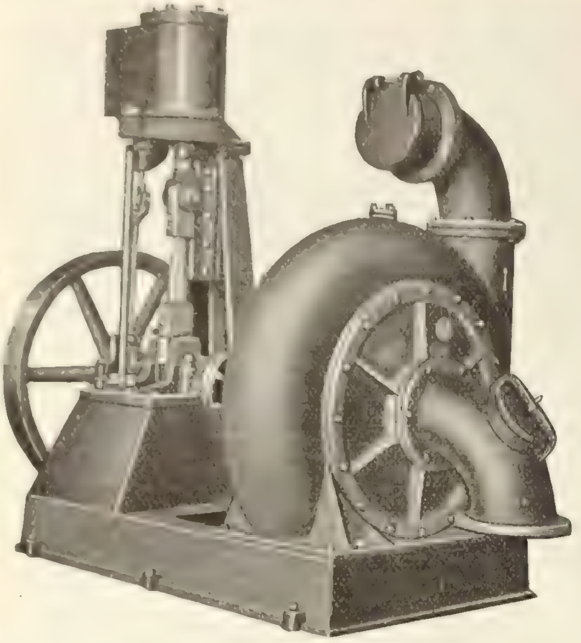

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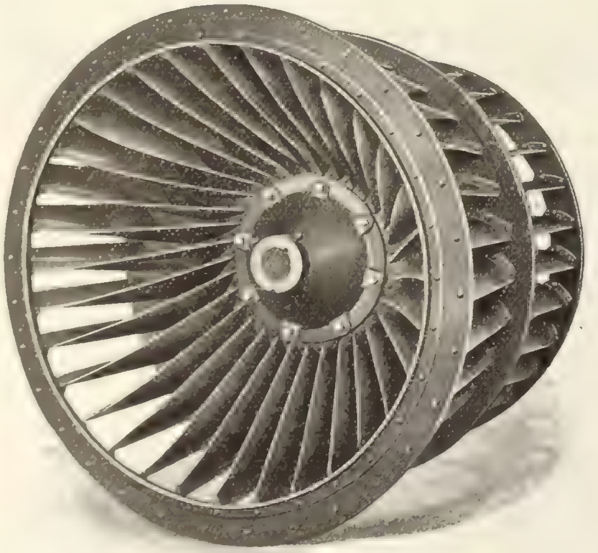

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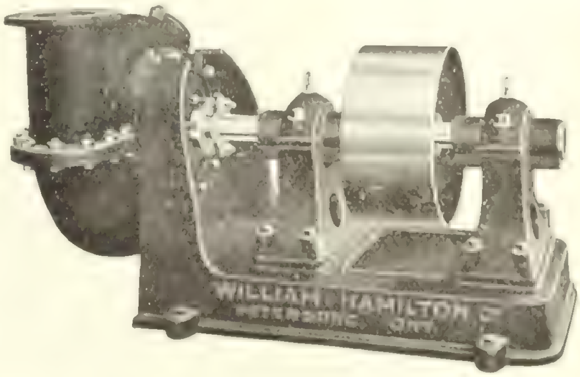

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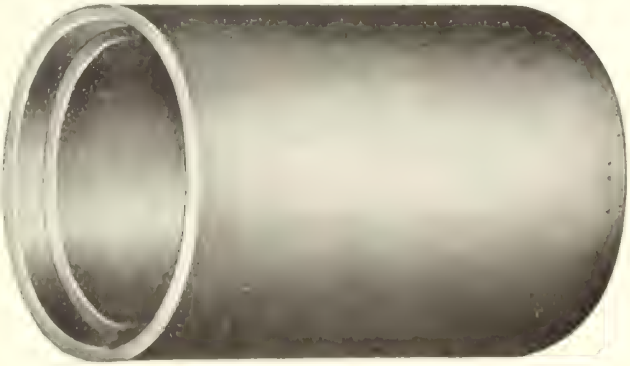

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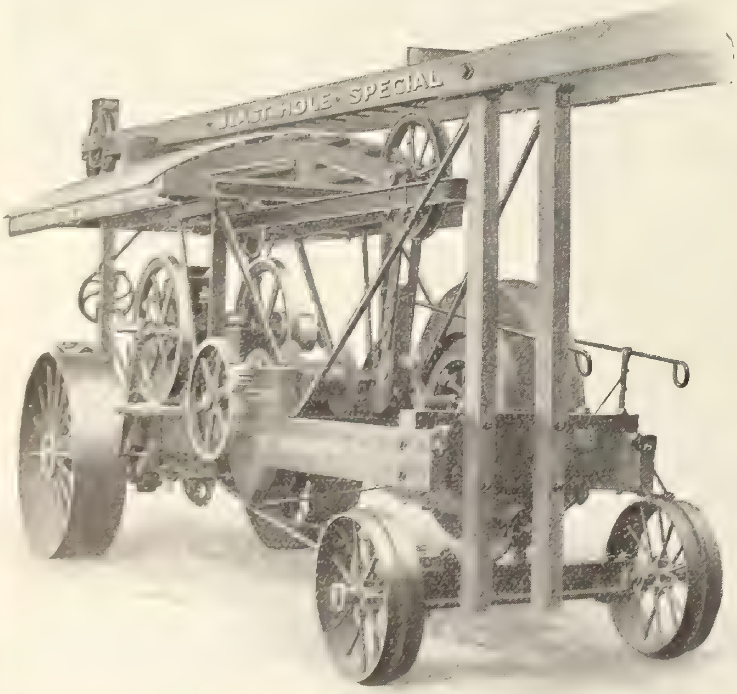

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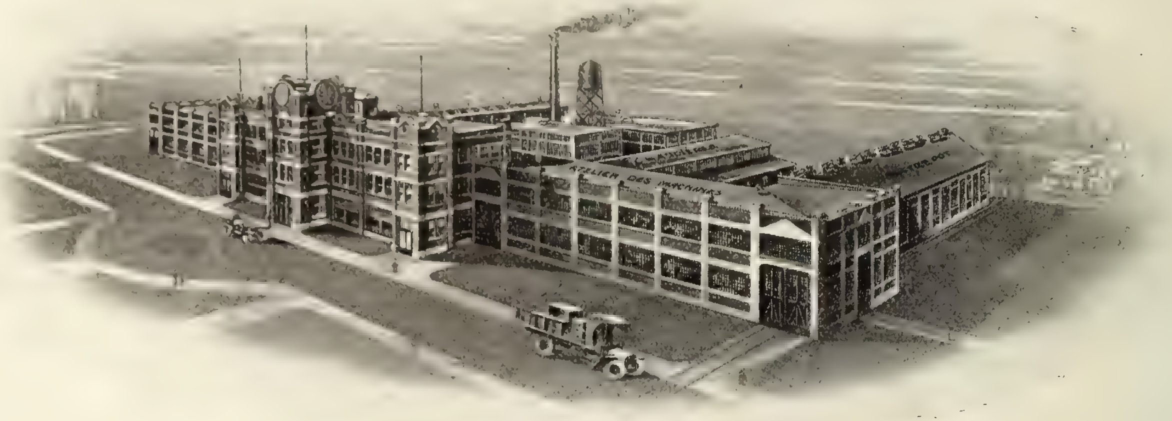

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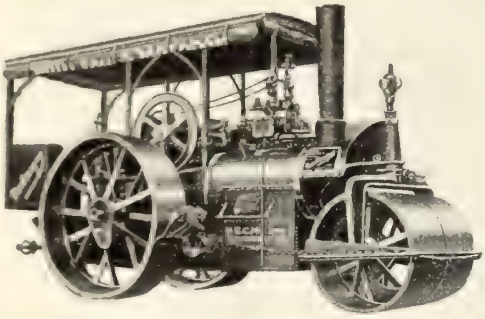
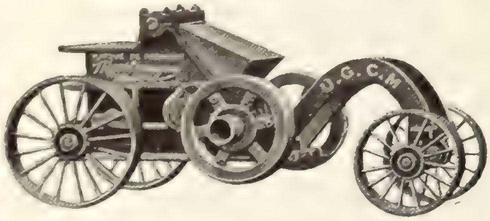


"Montmagny" Steam Road Roller.

"Montmagny" Portable Steel Bin.



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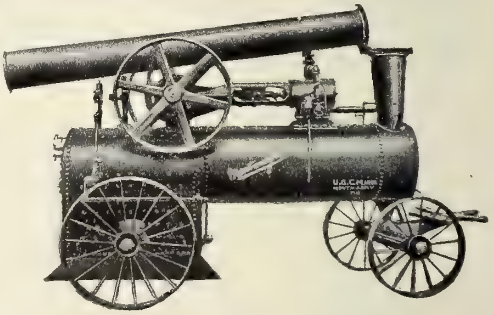

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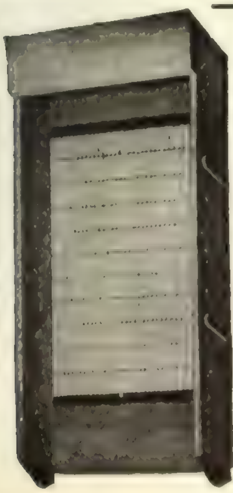

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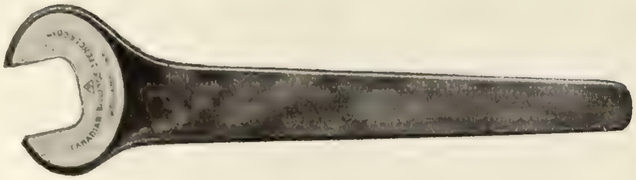

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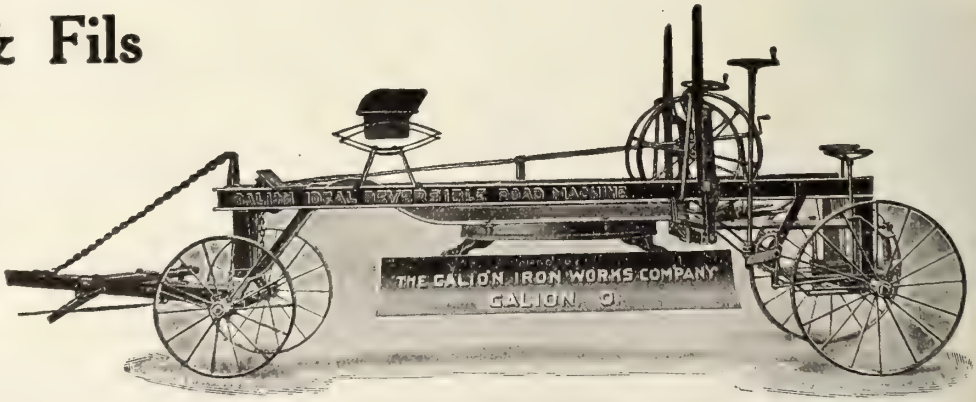
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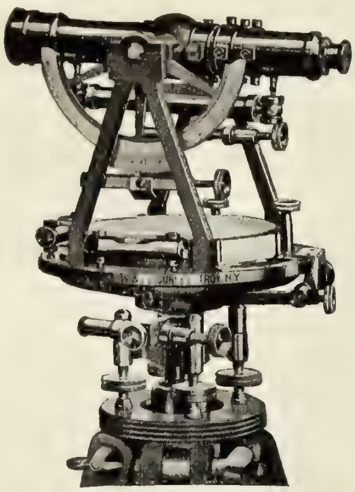

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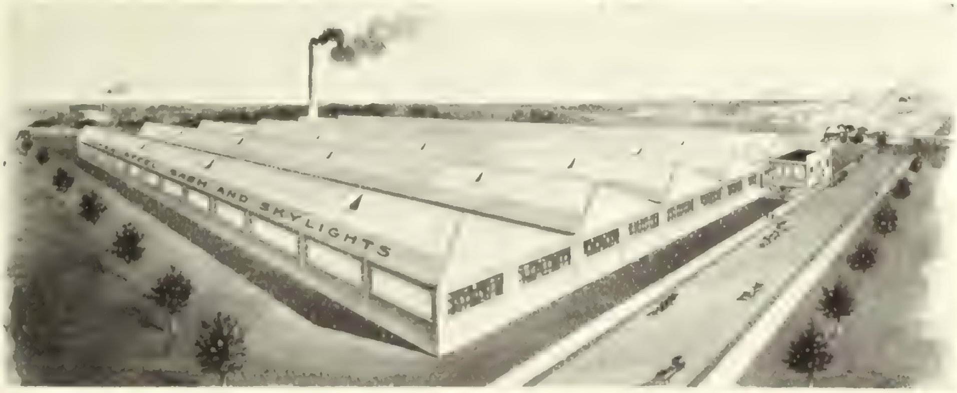
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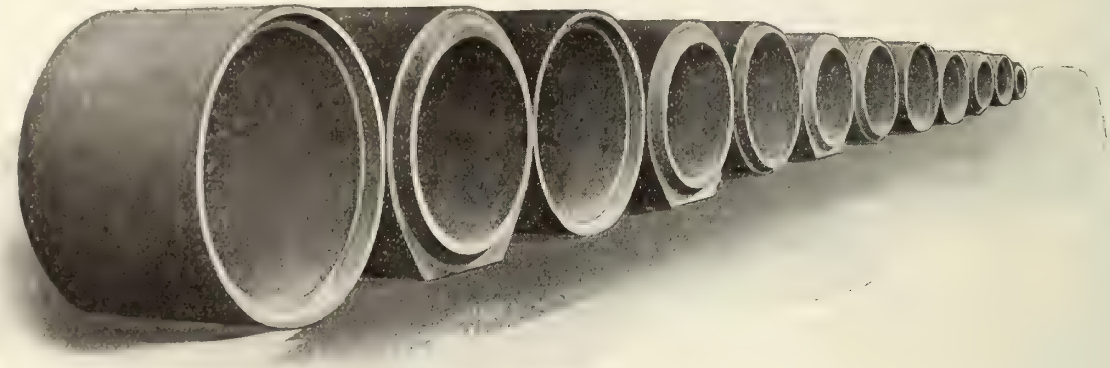

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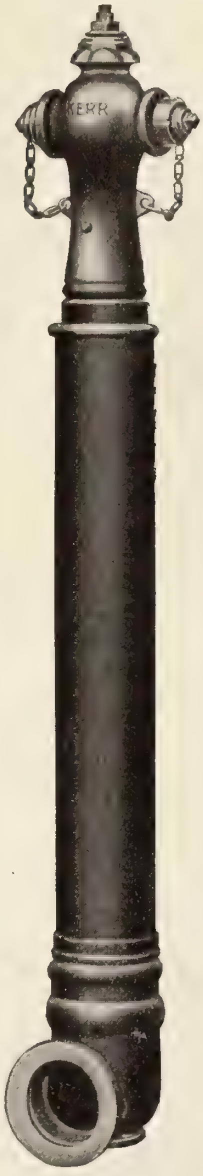

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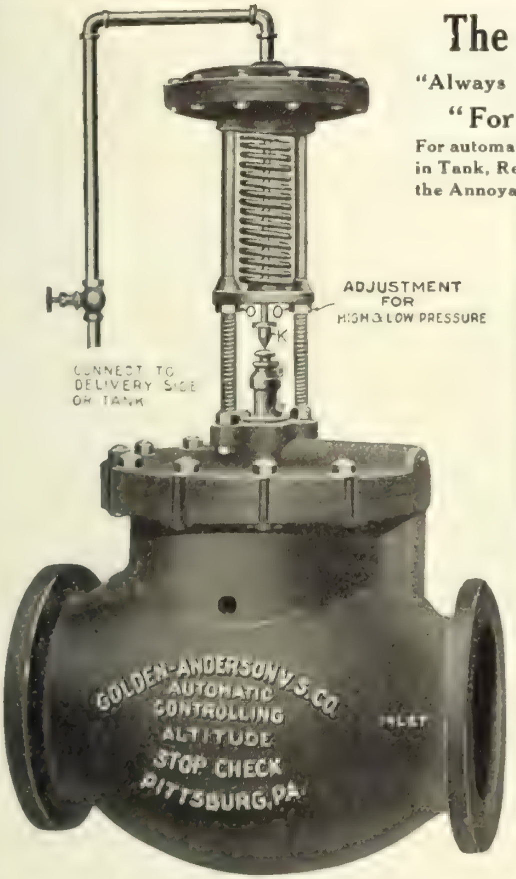
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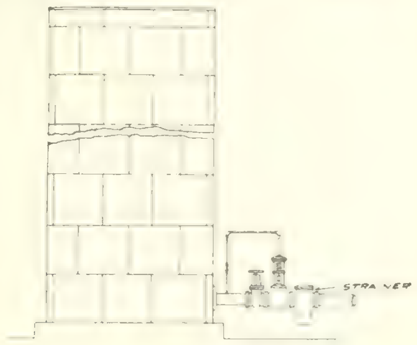

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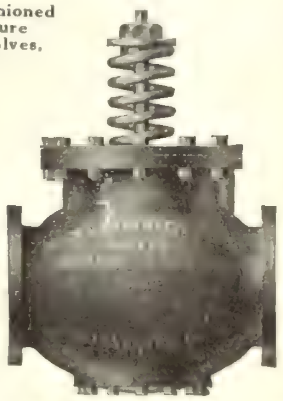

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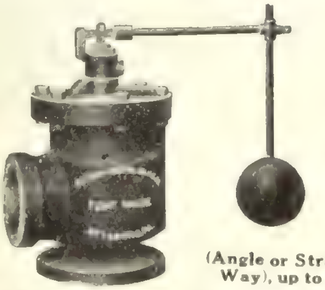

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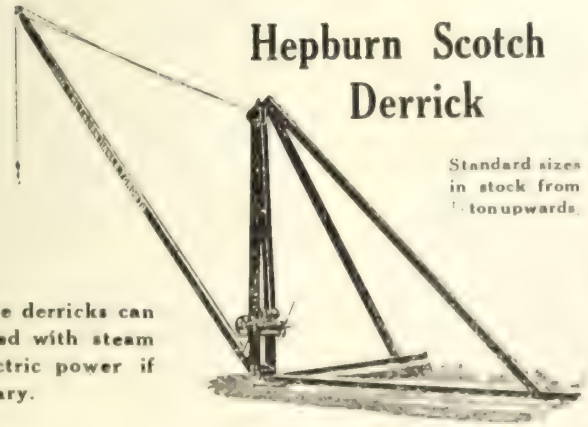

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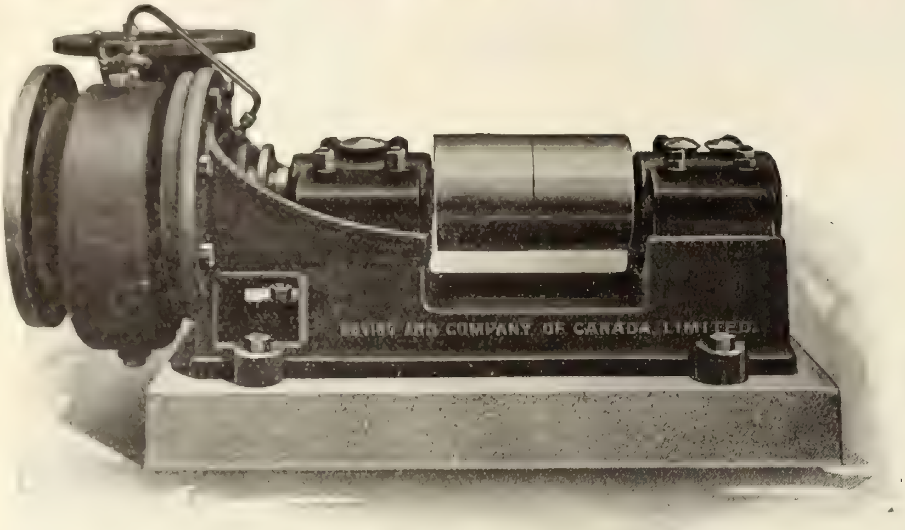

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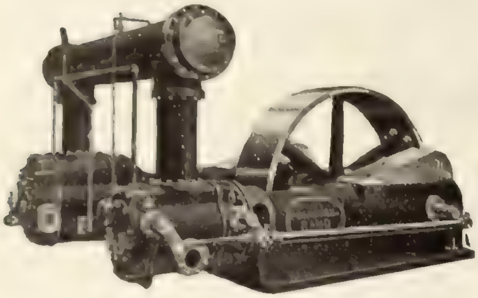

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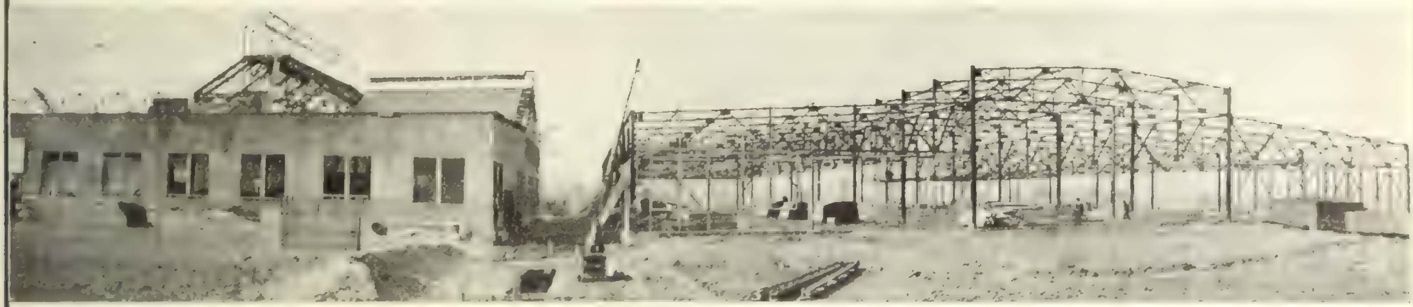

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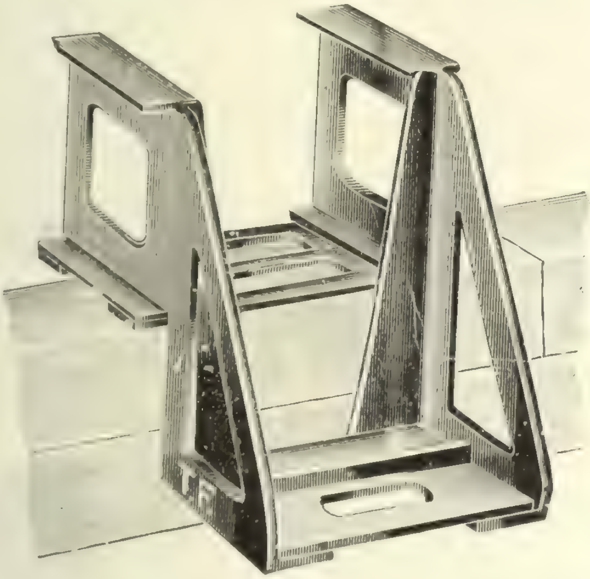

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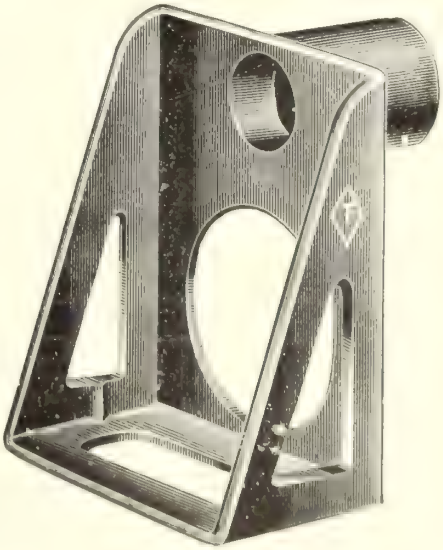

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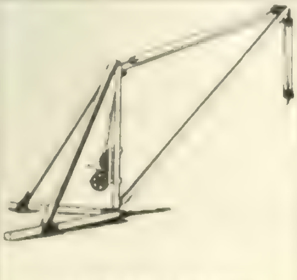

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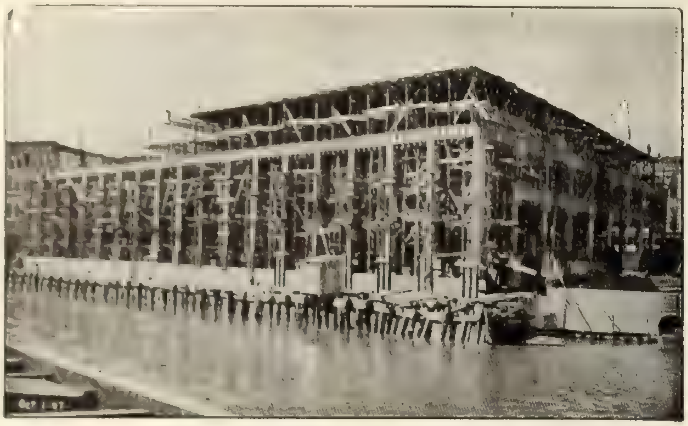

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ESTABLISHED 1886

Contract Record and Engineering Review

Published Each Wednesday By
HUGH C. MacLEAN, LIMITED
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - Tribune Building
CHICAGO - Tel. Central 6403 - 1155 Peoples Gas Building
LONDON, ENG. - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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Protection of Elevated Tanks and Standpipes from Frost

THE necessity for protecting elevated tanks and standpipes from the extreme cold which prevails at times during the winter in Western Canada is emphasised by the experience which the town of Moosomin, Sask., had with its standpipe last winter.

The tower is 80 ft. high by 16 ft. in diameter, and has a capacity of 100,000 imperial gallons. It is not housed in, and during the very cold weather an ice cap forms near the top. It is the aim of the authorities to keep the water as near the top as possible all the time, but there are times when the water drops lower than the ice cap.

On Saturday, February 14th, water was being pumped into the tower after a spell of severe weather. The man in charge of the pump was away for about fifteen minutes and on his return he found the pressure gauge had made a complete turn and was pointing beyond the 10 lb. mark, which would represent a pressure of probably from 130 lb. to 150 lb. a sq. in. Immediately he stopped the pump and opened a valve, letting off water and so reducing the pressure. An examination of the tank showed a leakage about the base and also two of the anchor bolts broken. Various opinions were expressed as to what had actually happened, and the writer was asked on the information given above to express an opinion as to what actually happened and to suggest the best means of avoiding any further trouble.

Owing to the pressure of 150 lb. due to the pumping there would be a very considerable upward pressure acting on the ice cap. Also there would be an equal and opposite pressure acting on the bottom. As the bottom rests on a concrete foundation it could not "give." The tendency would be for the tank to rise, and of course failure would occur at the weakest point, which would be at the bottom, where the flange angle on the vertical plate is connected to the bottom plates. The stress would come on the rivet heads, and there would be the slightest amount of movement, which would cause leakage between the angle and the plate.

If the anchor bolts were slack, this movement would probably not be enough to cause them to fracture. The two which broke were possibly already under severe stress before the additional load due to the tank rising came on them. This condition might easily arise from the fact that the plate of the standpipe to which the bolts are connected would be at a temperature above freezing due to the water inside, and the bolt would be at a temperature considerably below zero. The result would be that the bolt would contract and tighten up and on account of the brittleness due to a severe cold it would snap. As it actually happened, the leakage was between the flange angle and the bottom plate.

Regarding the lessons to be learned from the above occurence, it is obvious that too much care cannot be taken where a town or municipality is dependent upon a standpipe for the distribution of its domestic supply of water, and the best precautions known to prevent any failure should be taken. The business, health, comfort, sanitation and the best well-being of the community are dependent on the continuity of the supply of water. The town of Moosomin is fortunate in that the damage done was so slight. As long as no protec tion is given against the severe cold of this western country there is always danger.

In designing standpipes or any structures all known dangers are guarded against. A factor of safety is used for the steel, the strongest possible wind stress with the tank in the worst condition to withstand it is taken into consideration, and in very many cases in this country and the United States the danger due to the formation of ice is left out and the stand-pipe is left unprotected. Is this intelligent design? Does the saving made in the frost casing warrant taking chances when one takes into consideration how much depends on the continuity of the supply of water?

Many dangers are ever present and these, in some cases have caused complete failure. With a favorable combination of circumstances, the tank might be empty and the ice fall. The rivet shear might be increased beyond safety on account of the possible suspension of ice, or—on the withdrawal of water—on account of the formation of a vacuum and the increased stress due to atmospheric pressure, far beyond anything considered in the design. These and other possible dangers, such as happened to the Moosomin tank, all go to show the absolute importance of so protecting standpipes that there is no chance of ice forming within.

This can best be done by building around the standpipe a wooden casing, some few feet from the steel, to allow of stairs or ladders to the top, and heating this space possibly by means of the exhaust steam from the pump house or by some other means. The importance of this protection cannot be impressed too strongly on all towns or municipalities that are compelled to build stand-pipes to distribute their domestic supply of water.

Municipal Engineers and Experts

"There is no field of municipal work where the engineer has the opportunity to develop greater versatility than in the moderate sized city, according, say, with cities of the second class in New York State. Here the city engineer, appointed by the mayor, is a voting member both of the board of estimate and apportionment and of the board of contract and supply. He is called upon to exercise control over almost every kind of public work incidental to the modern city. The work may not be of the magnitude to be found in the greater cities, but its variety is far greater than that which comes to the engineer of cities of the first class, where jurisdiction and responsibility are subdivided. Having less of a certain kind of work to do, he takes it very seriously and it is often exceptionally well done.

"The practice of electing a city engineer by the council or other legislative body, or, as is done in some cases, by popular vote, cannot be too strongly condemned. Past experience has given good ground for the general statement that no man should be selected to do professional or highly technical work by election, whether that election be by the general public or by a legislative body. Those who are called upon to vote for candidates for such an office have no means of knowing their peculiar qualifications, or lack of qualifications, and better results will almost invariably be obtained if responsibility for the appointment of a man to do such work is vested in the chief executive of the city."

The above is part of an address delivered by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, before the graduate students in highway engineering at Columbia University; and there are two points in this brief quotation which seem to us to deserve special recognition—the reasons advanced for appointing rather than electing a city engineer; and the great variety of the work which he must undertake and the fact that this is "often exceptionally well done."

With the latter point we are frequently impressed as we come into contact with engineers of the smaller cities. The duties of the city engineer of a large city are often more executive than technical, and both he and his subordinates are too overwhelmed with details to give adequate study to the problems presented; and so for year after year they follow standard methods, use standard plans and specifications, and depart from the old standard of practice only after most of the more progressive moderate sized cities have led the way.

The city engineer of a medium-sized city has, in fact, unusual opportunities for obtaining wide engineering experience, since he is called upon in many cases to act as designing and constructing engineer in connection not only with sewers, water works and street pavements, but also bridges, street railway tracks, buildings, river improvements, retaining walls, and almost every kind of structure which is included under the head of engineering.

That he should be an expert in all of these branches is impossible; that he should be even reasonably competent in all of them is hardly to be expected, when we consider that, for the salaries ordinarily paid to city engineers, young and comparatively inexperienced engineers only can be obtained. City councils should realize this, and city engineers should not be ashamed to confess it, since it is certainly in no way to their discredit, and to seek expert advice on important or novel work.

Probably in no one feature are American cities so far behind the most successful European ones as in the proper utilizing of expert services—expert mayors as well as expert engineers; and city engineers should not only consider it as no reflection upon their ability, but should even recognize it as a duty to their city and to their profession, to insist that when they are called upon to undertake any important work, the city should employ an expert in that particular line to advise them. None but a large city could, of course, expect to retain on its payroll experts in various lines or even in one line; and an expert in one line would probably be less effective in carrying on the general routine work of a city engineer than the average man that fills that position.

The city engineer's duties are most diverse and important, and when well carried out deserve as much credit and may require as much talent as those of the best paid consulting expert. But part of his ability is the recognition of the times (which will come in the history of most of them) when the best interests of the city as well as his own reputation call for the advice of an expert in the particular subject involved, and he should not hesitate to urge that such advice be obtained. On the other hand, the city should not expect the engineer to pay for this advice, but should do so themselves; since they should realize that the salary which they are paying is not sufficient to engage for them expert knowledge in a dozen different branches, or probably even in one, but that the engineer, although not a specialized expert, is probably giving them more than their money's worth in carrying out the ordinary work entrusted to his charge.—Municipal Journal.

Day Labor vs. Contract Work

Specially contributed by J. W. Astley.

BEING often asked by head officials of towns and cities as to my opinion in regard to the question of day labor vs. contract work for every class of municipal work, and as the Contract Record is taken by nearly every municipal contractor and has a large circulation among engineers, I am submitting this article for the benefit of city officials, who, from their own knowledge and from the criticisms of contractors, will be able to form a very fair opinion on the question.

I may state that in forty-five years' engineering experience, I have had, for ten years, the responsibility of handling every class of civic work by day labor. For the last six years I have carried out this work under a system somewhat different from what is usually employed. In this respect I tender against outside contractors, who are furnished city material at the same prices that I am charged. In my tenders, I include the following overhead charges: interest, sinking fund and repairs to all machinery, time-keeping, book-keeping, superintendence, and a percentage for operating stores department.

A contractor has to carry his own fixed charges, so that practically the only difference between day labor, as I have to carry it out, and work done by a contractor is that I put up no deposit and the city becomes my security for the due fulfilment of the work. The inspection is supposed to be the same, but it is carried to the extreme in my case, so as to prevent any loophole for complaints. I am expected to carry out my work for my tender prices, and I have done so with very few exceptions. The average yearly value of work for the last six years has been close to $1,000,000.

A detailed statement is submitted at the end of the year and is published, so as to give the general public a chance to see the results of day labor. I am giving a plain statement of facts, as they carry great weight in regard to this question.

The city of Winnipeg owns and operates the following public utilities: unlimited electric power for light and power purposes, water-works—domestic and high pressure, gravel pits, stone quarry, crushing plant, railway cars for handling material; one stationary and one railway asphalt plant, storage yards with overhead supply bins, and machine shop equipped with up-to-date appliances; stores department, [illegible] tractors, rollers, sewer machines,—in fact everything that makes a contractor's outfit for certain classes of work and a certain amount of work.

The cost of material is as follows: broken stone, delivered, per cubic yard, $1.75; cement, in stock, per bbl., $2.10; gravel, delivered, per cubic yard, $1.25; asphalt, per ton, $25.00; flux, per ton, $22.50; limestone dust, in stock, per ton, $4.50; crushed granite, per cubic yard, $3.50.

Fixed charges are kept sufficiently high to leave a safe margin on an ordinary season's work. Naturally, if a very big season's work is carried out, more is raised than would cover what was calculated as wear and tear, etc. This extra amount is used to further reduce capital accounts on various plants.

Standard asphalt pavement, 3-in. ballast, 6-in. concrete, 1½-in. binder and 2-in. surface, costs $2.65 a square yard. This includes superintendence and timekeeping, 3c; sinking fund, interest and upkeep of plant, 7c per square yard; maintenance charge, 20c. Total 30c per square yard.

Extra fixed charges on all works:—

4 per cent. on labor for general tools and plant.

3 per cent. on cost of stores for operating same.

3 per cent. on labor for superintendence and timekeeping.

$15.00 per day for use of large concrete mixers, smaller size, $7.50.

$15.00 per day for steam rollers. $25.00 per day or its equivalent for gasoline tractors.

$25.00 per day for sewer machines.

These charges are exclusive of engineers' and helpers' wages.

The price per square yard for artificial stone sidewalks, of which there were 84 separate contracts last season, was:—

For residential streets, 8-in. gravel base, 4-in. concrete and 1-in. finish, per square yard ... $1.55

For business streets, 8-in. gravel base, 5-in. concrete and 1½-in. finish, per square yard $1.65

Prices per foot for 6-in., 8-in., 10-in. and 12-in. water mains were 27c, 30c, 35c and 40c respectively. This includes lead, hemp, and connecting to existing mains and hydrants. All water pipe and specials are furnished free by the city.

Prices for 12-in., 15-in. and 18-in. pipe sewers were 65c, 75c and 90c. These prices include all except cost of pipe.

Concrete sewers—The general average of cost of concrete is $8.00 per cubic yard, and excavation, 50c per cubic yard. I may state that this class of sewer is generally very deep, and our ground is known to be very treacherous, thus preventing the use of certain classes of sewer machinery.

With the aid of these prices and our fixed charges, contractors and city officials in other localities will be able the more readily to adjust any difference in cost of labor and material.

It will be seen that by having our own plants, we are well fitted to carry out a large amount of work and thereby keep our machinery working as many days as possible during the working season. At the best, in this climate, six months in the year is the most you can calculate on to make any machinery earn towards its cost of upkeep.

At the same time, it often occurs that tenders are called for more work than can be done in a given time by the machinery we own, and as it would be a poor policy to expend $10,000 to $12,000 for extra machinery simply in cases of this kind, outside contractors, in such instances, are expected to do the [illegible]

Engineer of Construction for the City of Winnipeg.

the same time, however, prices are kept down to a fair basis by the knowledge that the city could handle all the work if they wished to do so by purchasing more machinery.

Another very important fact that must not be lost sight of is that no matter how much or how little work a city may have, they cannot do work outside of their own civic works so as to try to keep both their men and machinery steadily employed. A contractor has this privilege, and can tender on other work as well, thereby giving him a chance to keep a well-organized gang steadily at work. Also the fact must be borne in mind as regards all civic works, that seldom is any endeavour made to order different undertakings so that one could be completed before the next is started. They are all usually ordered together, and must be carried out at once, as they are wanted immediately, for the simple reason that many of these expenditures have been put off as long as it was possible to do so with public safety. The city powers that be cannot be blamed for this, as it is only too often simply a question of finances.

Outside of a city having reasonably up-to-date plants, without having gone to the extreme for reasons given in a previous paragraph, they fail to do as cheap work as a contractor unless a competent man is given full control of men and machinery, and held responsible for the cost of the work. This is as good security as that put up by any municipal contractor, as any man who is fit for the position should never be put there by civic influence. He must stand or fall by past and present record, and any question of whom he shall hire must be cut out. In plain language, cut out ward patronage or quit day labor once and for all.

It may be considered by many that our fixed charges are excessive, but this is one item that is not given sufficient thought by city officials when contemplating the day labor question. Contractors have it drawn to their attention very forcibly when their hands have to go into their pockets for new machinery. My idea on this subject has been formed from many years' use of every class of machinery and I believe that as the city cannot claim or make use of any direct saving in the cost of any work, such saving going to the benefit of the property owners direct, a liberal collection should be made which would leave the cost of the work at a reasonable figure.

By this means, after the assumed life of any machinery is passed, and consequently paid for, it can be scrapped if thought advisable, either on account of the cost of the yearly repairs exceeding one-half the expected revenue, or because it has become out of date. The question of machinery becoming antiquated is a much more important one than many people think. Many classes of machinery are out of date in five years, where the life might be safely placed at ten years. Once the saving on operating on account of any improvement will more than pay for the general upkeep of the older machine, it is time to scrap it, otherwise your outfit will be going further behind before the next change occurs.

It can also be taken as a fact that will bear no question of an argument, that the average of all work will be of a better quality than if done by many so-called municipal contractors. Many of this class of contractor is here to-day and gone to-morrow, and as very often happens in municipal work, many unforeseen difficulties crop up that cause the work to be more expensive than was assumed, and still cannot be claimed as an extra. A contractor, unless he is overburdened with cash, must slip over these places at the least loss to himself, whereas the city can, and should, afford to expend whatever is necessary, even if by so doing the cost over runs the original tender price.

If it was possible for one or two reliable municipal contractors to be awarded all city work, it would be a different matter. They would then have the same incentive to do this work as a lasting record to themselves. If a town or city decides to adopt the day labor principle, there are many things that they had better leave alone, especially large buildings and certain classes of other work that only come once in a while, and require a different plant than that in general use. This would mean carrying a large outlay in dead plant, besides requiring certain skilled labor that is too high-priced to be used on any ordinary work; consequently on these odd jobs you would only get the left overs in the way of skilled labor, which is dear at any price.

Winnipeg Procedure

After tenders are advertised for and bids are received, the tender which is lowest is recommended by the Board of Control to the Council, and if my bid is accepted I am notified to proceed. You will thus perceive that the two governing bodies of our municipal system have made themselves responsible to the people for the due fulfilment of the work, both as regards the time limit for completion, and the stated cost of the work. Under the circumstances, I consider that I hold a very responsible position, having the reputation of the two civic governing bodies as well as my own at stake, and must "make good."

I will state that I have never been asked by any members of the Board of Control or City Council to accept any man as foreman on these works. The same applies to laborers. If this system is carried out, day labor can be made a success, and the average cost of all work will be cheaper than any contractor can afford to do it for.

There are exceptional cases when, if a contractor wishes to keep his gang together for other work he had in view, he can afford to take civic work at cost prices, in which case if he comes out clear, he has actually made it pay, as the loss in wages of making up a new gang amounts to a considerable sum in dollars, besides the question of efficiency in keeping a well trained gang ready for the next job.

Winnipeg was the pioneer city to go into the question of building and operating their own municipal asphalt plants and doing all their own asphalt work. The effect of all this class of work being done by the city is very apparent. We can justly claim a more even quality of good pavements and cheaper to keep in repair than any city on the American continent. This is simply owing to a uniform system being carried out in regard to mixing and laying pavements from year to year, any repairs being made as required, not to suit the time and convenience of various contractors as would be the case if repaired under the guarantee system. It would not be possible to lay as even a class of pavements if several contractors were engaged in the work during different years, and the figures given in a previous paragraph will show that no contractor could afford to compete and make a fair margin of profit.

To make it pay a town or city to go into this class of work, they should be able to see that under ordinary conditions a certain amount would be required every year. If there is a rush one year and very little done the next, it means carrying over overhead charges to a second year, which is not a good policy, but if sufficient asphalt pavements are already laid that are past their guarantee period, and there are others that still have some years of the guarantee period yet to run, these two can always be counted on to make a certain amount of work for a municipal asphalt plant, and will help to carry the overhead charges.

I am a firm believer in day labor if carried out as a business proposition, but if attempted to be carried out as in many cities south of the line and in many of our own Canadian cities, under the old style of city council and ward politics, it cannot be made a success. It simply means taking the property owners' money and distributing it among the working class, under the mistaken idea that the city is better off because many men who are residents receive employment on civic works, but which no contractor would hire at any price except to fill a gap until he can pick up something better.

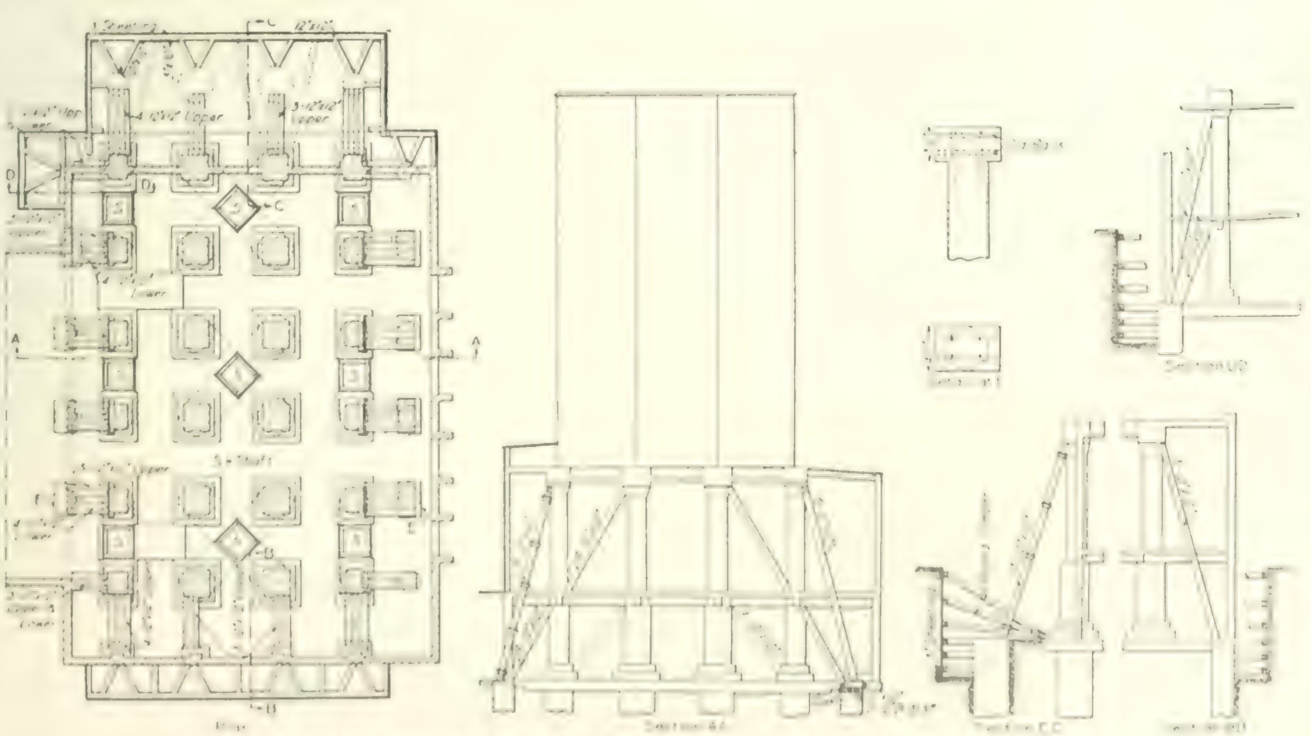
I have seen civic works carried out by so-called day labor on both sides of the border, under practically the above system, and the estimated extra cost was at least 30 per cent. over what it should be, but as the old saying is, "the people get what they want and so have no kick coming."

Underpinning Work-House Adjacent to Tilting Grain Elevator at Transcona

To forestall the settling of the tall, heavy work-house adjacent to the Canadian Pacific Railway's grain elevator at Transcona, Canada, which is leaning at an angle of 24 deg. to the vertical as a result of recent subsidence of the blue clay foundation, a contract for underpinning has been awarded to the Foundation Company, Limited, of Montreal. The main elevator settled 26 ft. on one side and was thrown 30 ft. out of plumb in a height of 102 ft., but no material settlement has yet been observed in the work-house. The underpinning work is now in progress and consists essentially of a method of affording preliminary support for the entire superstructure on inclined shores, and subsequently sinking shafts to rock under the column centers and constructing in them new footings on which the building will be underpinned.

The 45 x 70-ft. work-house is 152 ft. high above the ground and extends 16 ft. below ground to the top of a monolithic concrete foundation slab 4 ft. thick which is heavily reinforced and receives the square footings of twenty-four cylindrical columns arranged in four longitudinal rows. The estimated total weight of the building and contents is 5,640 tons. The interior columns each carry 313 tons live load and 415 tons dead load, while the exterior columns carry 157 tons live load and 215 tons dead load. The foundations rest on a bed of clay about 40 ft. thick, below which there is a stratum of gravel and disintegrated rock extending to bed rock about 54 ft. below the surface.

The unstable condition of the soil, demonstrated by the excessive displacement of the adjacent building, made it very hazardous to disturb these foundations until independent support was provided for the super-



Details of shoring and arrangement of shafts and drifts for underpinning columns of Transcona work-house structure. The entire weight of the building was therefore transferred to temporary new foundations through a system of inclined shores on exterior piers with a factor of safety of three.

A sheeted trench, heavily braced with 12 x 12-in. horizontal timbers, was excavated around all four sides of the building to a depth below column footings, and in it twenty foundation pits were sunk to rock opposite the exterior columns and about 10, 13 and 15 ft. distant from them on centers. The two pits at each corner, eight in all, were excavated inside a sheeting of sectional cast-iron cylinders with courses 4 ft. high, which were loaded with steel rails suspended from an upper platform.

The experience and information obtained by sinking these pits enabled the contractor to sink the remaining pits, 5 and 6 ft. in diameter, by the Chicago method, substituting for the cast-iron casting vertical wooden staves with inside flanged steel rings. The piers on the longitudinal sides of the building were filled with 1:2:4 concrete and the larger ones at the ends were filled with 1:3:5 concrete. They were capped with enlarged rectangular pedestals to receive the feet of the inclined shores. The thrust was resisted by horizontal rails embedded in the concrete and bearing against vertical rails reinforcing the top of the pier and distributing the stress into the pier shaft.

Transferring Column Loads

The column loads were all transferred to the new exterior piers by a system of heavy multiple inclined shores transverse to the longitudinal axis of the building. These shores were arranged in pairs, one shore of each pair engaging the adjacent exterior column at the second floor, and the other engaging the adjacent interior column in the same transverse plane at the second floor level. The corresponding pair of shores in the same plane on the opposite side of the building completed the support for one transverse row of columns, and with the solid floor connecting the columns formed an arch-like construction through which the total weight of the upper storeys was transferred to the new outside piers. Provision was made for the insertion of additional bracing from the bottoms of the exterior columns to the first floor, as indicated by dotted lines, but their use has not been found necessary. The tops of the exterior foundation piers and some of the footings of the columns in the building are braced by raker struts to the bank on the outside of the trench.

Underpinning

The shores are made of full length 12 x 12-in. timbers, from two to four in a set. In the heaviest long shores the separate pieces lie in the same inclined plane and are thoroughly clamped together with yokes made of a pair of screw rods with nuts engaging bearing angles on the opposite sides of the struts. The upper ends of the outside two-storey shores engage horizontal bearing pieces or caps consisting of 12 x 12-in. timbers 6 ft. long reinforced by a pair of 12-in. channels fitted on opposite faces and securely bolted to them. These pieces are set in seats cut out of the concrete at the tops of the columns, and distribute the shore pressure over the entire width of the concrete. The other shores have their ends bearing directly against the dressed surface of the concrete. The shores were adjusted and brought to bearing by heavy oak wedges at the lower ends.

The monolithic concrete slab which forms a continuous footing under the entire area of the building will have nine openings cut through it to give access for the underpinning excavation. These openings, about 6 ft. square, will be located so as to give access to the greatest number of columns without involving unnecessary cutting of the foundation slabs. Three of them will each give access to four interior columns, and the outer ones will each give access to two exterior columns.

From these openings excavations will be sheeted down about 6 ft. below the bottom of the concrete and drifts will be run from them to the centers of the adjacent columns under which shafts will be excavated by the Chicago method already described, carried down to rock, and filled with concrete, adjusted to bearing under the column bases so as to continue the support of the latter directly to solid bearings.

Each shaft will be equipped with a small individual electric hoist, and the spoil buckets will be suspended from trucks engaging horizontal tracks on which they will be carried through the drifts to the common opening in the foundation slabs. In the excavation of the exterior shafts for the shoring piers, the spoil buckets were handled by windlasses operated in groups by a rope drive.

The work is being executed under the supervision of A. I. Campbell, superintendent for the contractors, and Frank Lee, principal assistant chief engineer in charge of the work for the Canadian Pacific Railway Company.

City Engineers vs. Private Engineers

An engineer of wide experience both in municipal work on salary and in private practice raises a question of engineering ethics. Should engineers on city payrolls at presumably full-time salaries, and with no private offices and no personal staff, compete for outside work with engineers who have to maintain both?

In such cases the public official or employee has no office rent to pay, and if he has sufficient energy and executive ability he can call to his aid his fellow employees and thus carry on a business of considerable magnitude practically clear of all charges except those for strictly personal services.

Two main points are more or less deeply involved: (1) The two-thousand-year-old question, "Can a man serve two masters?" with its well-known and generally accepted answers; and (2) fairness of competition with engineers in private practice who must meet office rent and other overhead charges. The chief danger as regards unfair competition lies in the temptation to take advantage of lack of overhead charges and to offer to work for lower fees in order to get more engagements or engagements more easily. This danger could be obviated by charging a standard fee—if there is such a thing that can be adjusted to various degrees of education, experience and ability.—Engineering News.

Among the most important foreign bridges now under construction or completed last year there were recently enumerated in the "Engineer" the Sara railroad bridge over the Lower Ganges, comprising fifteen 359-ft. spans, with foundations carried down to a depth of about 162 feet below water level. It is being built at an estimated cost of more than $6,000,000. The Allahabad railroad bridge in India is 1¼ miles long and has forty 150-ft. spans. The Potergy River bridge in Brazil has ten 164-ft. spans. A viaduct on the railroad from Miramas to L'Estaque in the south of France is 3,093 feet long.

Ford Motor Company of Canada, Ltd
Ford Motor Company of Canada Ltd

Ford Motor Company's proposed new factory at Toronto. Estimated cost $250,000. Architect: Mr. John Graham, Detroit. Contractors: F. J. Mark Construction Company, Birmingham, Alabama.

Ford Motor Company to Have Fine New Factory at Toronto

REPRODUCED herewith is the architects' perspective of the new factory which the Ford Motor Company of Canada propose to erect on the northwest corner of Christie and Dupont streets, at a cost of $250,000. The new addition will be five storeys high and the exterior will be of face brick trimmed with terra cotta. The building will be absolutely fireproof, and the flat slab construction, giving a maximum span between the columns, will be adopted. A roof, paved with tile, will afford 21,000 square feet for testing. There will be two large freight elevators, one running to the roof, and two service stairways. A covered loading platform will enclose a space 95 ft. by 50 ft. The floor area of each floor will be 21,320 sq. ft., and the floor area of the entire building, not including basement and roof, 106,605 sq. ft. The heating apparatus will be installed in the basement, which has an area of 5,000 sq. ft. Excavations for the building are now in progress. The architect is Mr. John Graham, of Detroit, Mich., and the general contractors are Messrs. F. J. Mark Construction Company, Birmingham, Alabama.

Contraction and Expansion in Buildings

IN order to determine the effect of temperature upon a new building recently constructed in Cambridge, Mass., the Aberthaw Construction Company has had made by Professor Howard, of the Massachusetts Institute of Technology, some very carefully standardized measurements on the Carr & Davis 5-storey reinforced concrete factory, erected by them in 1913 from designs of Monks & Johnson, of Boston.

The building is about 381 ft. by 61 ft., the floors being of the mushroom or flat-slab type. The outside is embellished with a tapestry brick veneer on corner bays, and also on curtain walls below the windows above the first floor.

The first measurement, made on a sunny morning, November 7, 1913, showed a temperature on the ground in front of the building of about 70 deg. F.; while that on the roof, where the upper measurements were made, was about 57 deg. F., being in the shade of the parapet wall. Points for measurement were established at the corners of the building, by round-headed brass screws set into lead expansion shields and well anchored into the concrete wall. Intermediate points, established by stakes driven into the ground approximately 100 ft. apart, were on the same level as the two end points and exactly in line with them.

Measurements were made three times to obtain averages; and the temperature was taken by three standardized thermometers—one at each end, and one at mid-length. After making all corrections to the steel tape used, the length was found to be 382.559 ft. at a mean temperature of 69.8 deg. F.

The measurements in the upper part of the building, made from the roof, were located about 3 ft. above the roof level, and were set in the same way as those in the bays. Three separate measurements were made here also, the final length being found to be 379.437 ft. at 56.9 deg. F.

February 12, 1914, on a cold day following several cold days, three measurements at the base gave an average of 382.552 ft. at an average of 17.4 deg. F. Three measurements on the roof gave a mean length of 379.377 ft. at a mean temperature of 6.2 deg. F.

These measurements seem to indicate that the upper part of the building contracted .06 ft. in a range of 50.7 deg. F.; the base line contracted .007 ft. in a range of 52.4 deg. F.

In addition to direct measurements, vertical lines were established between the bottom and top of the building. The top point at the west end of the building was found on February 12 to have moved east .02 ft. The top at the other end of the building was found to have moved west .026 ft. Three intermediate points all moved well in amounts varying from .01 to .024 ft. This bears out the generally accepted idea that a building contracts more at the top than at the bottom in cold weather, and correspondingly expands more at the top than at the bottom in hot weather.

The Modern Type of Cement Gun and Its Work[*]—Part II. (Conclusion)

By Carl Weber

REMARKABLE as an example of repair work are the concrete piers of the Dover Street Bridge in Boston. Fig. 12 shows the condition of the piers after the worst rubbish had been cleared away and also very plainly shows the line to which the tide rises at regular intervals. During high tide the piers are almost completely under water and therefore ordinary repair work would have required the construction of a temporary cofferdam around the pier. It was then decided to use the cement gun for this work and Fig. 13 shows the successful completion of the work.

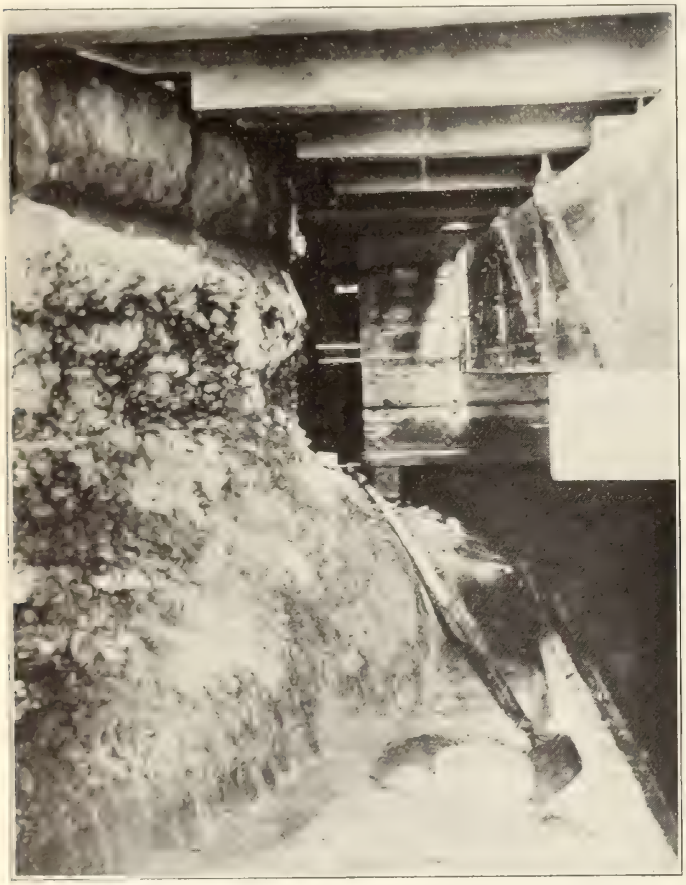


Fig. 12—Concrete piers, Dover Street Bridge, Boston.

All the work was done between tides, without any forms or other equipment. Fig. 13 shows very plainly the tidemarks on the new work. The cement gun deposited the material with such force, and compacted the same so densely, that even the rising tide could do no harm to the new gunite work.

The same conditions had to be met on the repair work of the sea wall at Lynn, Mass., and on numerous other jobs all along the Atlantic and Pacific coasts.

In Fig. 14 the cement gun is shown on tunnel repair work. The brick lining in the single track tunnel on the Chicago, Milwaukee & St. Paul R. R. near Tunnel City, Wis., was badly worn by the locomotive blasts. The mortar filling on the roof had been so damaged and the lower course of bricks so worn away that repair work became necessary. The tunnel is 1,330 ft. long. There being an average of 32 trains per day at this point, and all tonnage freight being operated with pushers, this allows very short working time between trains and therefore the repair of the tunnel was a difficult problem. The method finally adopted was to place a gunite coat over a strip 8 ft. wide on the under side of the centre of the arch and the results have been satisfactory.

Before placing the gunite the surface was cleaned with a sand blast. No. 3 triangular mesh reinforcement was used in a single layer and placed in 8 ft. lengths at right angles to the tunnel axis. The gunite was applied in two to five coats, depending upon the thickness necessary. The concrete never extended into the old lining for a distance greater than the thickness of one brick and projected 2 in. beyond the old face of the lining. This made the total thickness vary from 4 to 6 in.

In planning for this work it was thought that some form of shield would be necessary to protect the fresh concrete from locomotive blasts until it had thoroughly set, and a movable shield to be supported from the roof was accordingly built and used at the beginning of the work. It was soon found, however, that the cement placed by the gun was so hard immediately after placing that the locomotive blasts had no effect upon it and the use of the shield was discontinued.

The portable compressor plant was located at the east portal, a 2 in. pipe was carried through the tunnel with connections at frequent intervals, and the cement gun and mixing board were carried on staging supported by two standard gauge cars coupled together. A Fairbanks-Morse gasoline locomotive was used to push the equipment in and out of the tunnel. It was necessary to remove the entire outfit to a siding at the east portal for every train movement. The work was carried on for about two months, the progress being about 210 ft. a week.

Another interesting piece of railroad work is shown in Fig. 15. The picture shows a portion of the deep rock cut on the Erie R. R. just outside of Jersey City known as the Bergen Hill Cut. The work of the cement gun consisted in cleaning the fissures between the different layers of the rock and then filling them with cement mortar to eliminate the danger from falling rocks and to retard disintegration. The hanging platforms used for this work and the simplicity of the whole arrangement are shown.

Of an entirely different nature is the work shown in Figs. 16 and 17, which illustrate a coal bunker about 25 ft. wide, 20 ft. deep, and 150 ft. long. This coal bunker, which is built at the Haskell-Barker Car Company's works at Michigan City, Ind., was lined with gunite in order to protect the bunker against abrasion and the action of the sulphur in the coal, which will weaken the steel work in a short time. The lining is 2½ in. thick, reinforced with No. 7A American Steel

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[*] Abstract and re-arranged version of a paper presented last month to the Western Society of Engineers, Chicago, and published in the April ournal of the Society. In co-operating with the Editors of the Contract Record in the reproduction of this paper (in two parts, in the issues of April 29 and May 6), Mr. Weber kindly offers to deal directly with any enquiries through our correspondence columns.

& Wire Company's triangular mesh. This mesh is fastened to angle irons riveted to the steel work for that purpose. The work has proven successful and although no provisions whatever were made for expansion joints, not a crack appeared in the work.

There is a large field for this class of work, as practically no protection is given the steel work in such bunkers at the present time. The saving in cost for repair and renewal is soon equal to many times the cost of the gunite lining.

Numerous old and new steel bridges and viaducts have been coated with gunite to protect the steel work against rust and the corrosive action of the gases emitted by locomotives, etc. The gunite covering also deadens the noise of traffic over these structures and greatly improves their appearance.

For old bridges, where the corrosion has gone so far as to practically demand renewal, the cement gun suggests the reconstruction at a saving in cost by a new process. The steel work after having been cleaned and freed from all rust, scale, and loose paint, is wrapped with wire mesh. To make up for lost steel area and to provide additional strength, reinforcing bars may be placed as in ordinary practice and then the whole structure coated with gunite from 2 to 6 in. in thickness as conditions may demand. In this manner the old structure can be saved, practically a new bridge being formed without interruption of service and without any great expense for forms, scaffolding or the like. The reconstructed bridge will then be a permanent structure and of superior strength and appearance to the old one.

Figure 18 shows the new South High Street Viaduct at Columbus, Ohio. The length is about 350 ft. and the width is 70 ft. The steel work of the entire structure, including columns and braces, has been coated with gunite about 2 in. thick and the appearance of the work after completion is illustrated. In Fig. 19 we have a close view of the nozzle at work on this job. The air compressor and gun are standing on top of the steel work, and the wire reinforcement and the process of coating can be seen.

For coating the steel in our modern skyscrapers and other steel skeleton structures gunite has been used with success. In Fig. 20 we have a close view of some of the steel work of the new 56-storey Woolworth Building in New York. In this giant of skyscrapers practically all of the steel work has been protected by covering with gunite.

Use for the cement gun was found in the new Grand Central Terminal Station in New York, where over 3,800,000 sq. ft. of steel work was covered.

Extensive waterproofing work has also been done at the Chicago Stockyards and elsewhere and this branch of the work is rapidly expanding.

For fireproofing purposes, the cement gun is valuable. Old corrugated iron sheds, warehouses, and factory buildings can be transformed into permanent structures even if already badly rusted. The cost for this work is comparatively low and can be carried on in most cases without interfering with the service of the buildings.

The work of repairing the spillway of the Public Service Corporation at Joliet, Ill. The spillway is 90 ft. wide and has a swift current. The material had to be shot across the channel, the gun being located at the other side. Practically all the work had to be done from scows. The work consisted of placing a 6 in. curtain wall over the badly deteriorated face of the foundation wall of the station. This curtain wall is [illegible] ft. long, 12 ft. high, and is reinforced with ½ in. steel rods and American Steel & Wire Company's triangular mesh No. 7. The greatest difficulty was encountered by the inflow of water due to leaky gates from the station. Numerous drains had to be placed in the work to overcome this trouble. The curtain wall encases and protects the intake pipe for the railroad water supply station which carries water at a pressure of about 90 lb. per sq. in.

From these descriptions and illustrations the value of the cement gun for engineering and architectural work will be appreciated. At a later time I hope to be able to give more explicit information along some new lines now in the stage of development. I refer especially to the use of the cement gun for the manufacture of concrete units for building construction, as, for instance, floor and roof slabs, curtain wall sections, hollow floors, beams and columns, pipes, fences, etc. I am sure that the results will practically open a new branch of reinforced concrete construction. For example, two H-shaped gunite beams, 12 in. high and 12 in. wide, were recently made. The web and flanges are 1 in. thick, reinforced with single layers of American Steel & Wire Company's No. 7A, triangular mesh. The longest span between supports was 12 ft. 6 in. and these extremely light beams were tested up to [illegible] lb. of live load per square foot of floor space. At this load the final result was the toppling over of the load, beam, etc., which of course fractured the beams. The beams and tests were made in a rather crude way and therefore the results are not conclusive; but these indicated the enormous strength of pre-molded gunite members as compared with ordinary concrete and also the resulting economies. Especially remarkable is the

Fig. [illegible] Same view as Fig. [illegible] after using the cement gun ease with which they can be molded with the cement gun even if of complicated design.

Practical Points Elicited From Discussion

The following abstract of the discussion which succeeded the reading of the paper brings out many interesting points regarding the general utility of the cement gun. The questions were put by various members in the audience, and answered by Mr. Weber.

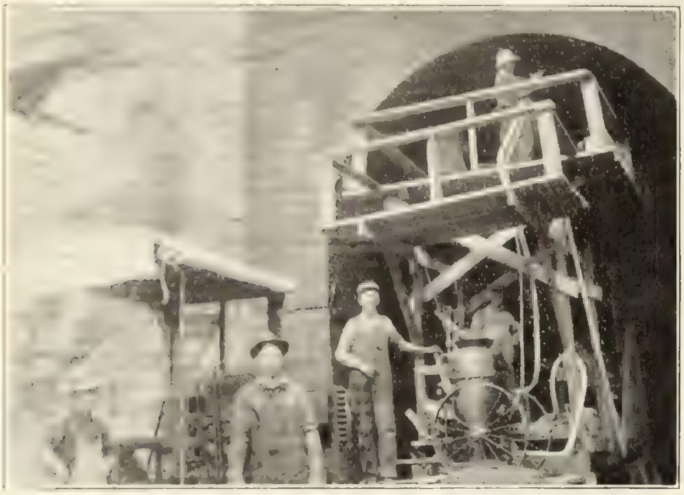


Fig. 14—Use of cement gun on tunnel repair work.

Q.—The author has stated that the velocity of the sand and material from the gun was about 300 ft. per second. I would like to know what is the velocity of the air.

A.—The velocity of the air is, as near as I can remember, about 380 ft. per second. The air, of course, must move more rapidly than the material itself. I might mention that we have, every minute, about 150 ft. of free air discharging through a ¾ in. nozzle, and it is very easy to figure the absolute velocity.

Q.—I notice the author spoke of the material being deposited at 100 per cent. efficiency. If some improvements are made in the gun—as there surely will be in the next ten years—I am wondering what its efficiency will be then.

A.—Any improvements which will be made in the cement gun in the future will be along the lines of greater facility in handling it. These improvements will mean larger guns with greater capacity and an attempt to reduce the cost of operation by finding some way to get along with less air than is now being used. We all appreciate that considerably more power is used than should be necessary according to the best theories. There is at present a great loss and waste in this respect, which we shall probably overcome with improvements. To get greater efficiency out of the material will of course be impossible.

Q.—The mere patching of concrete work has been a thorn in the side of everybody responsible for its maintenance for a generation. If the cement gun offers a way out, which I think it does, that alone is a tremendous achievement. Has gunite ever been applied to wall surfaces to waterproof them against a head of water on the other side?

A.—A good deal of such work has been done in the new Sears-Roebuck plant here in Chicago. On account of the great density of the material, it is especially suitable for this purpose. Of course, we have to insert weeper pipes in the wall to temporarily drain off the water. After the coating has set around these pipes, they can be stopped up. This work has been done very successfully.

Q.—How does gunite resist sea water as compared with ordinary concrete?

A.—On account of the density of the material, the action of the alkali in the water is at least greatly reduced. The action of alkali on cement can take place only if this salt enters the mass and causes a chemical change in the concrete itself; where this cannot take place, naturally there cannot be any destructive action

Q.—In the case of the Woolworth building in New York, what did they do to remove the paint that might be on the surface of the steel?

A.—The cement gun is also a very effective sand blast. We use it for sand-blasting purposes in a great many instances by using sharp sand only and directing the material against the wall at a cutting angle. Paint, rust, and scale are thus easily removed. As a rule, after we have sand-blasted a surface we shut off the sand and go over it again with an air-blast to blow away the last portion of any loose material which may have lodged in the corners.

Q.—Is it advisable to remove the paint from the surface of the steel before applying the gunite?

A.—As a rule, this is done only on surfaces where the paint is affected. But in cases where the steelwork has only the factory coat, if this coat is in good condition it may not be necessary to remove it. If the paint shows defects, it is advisable to remove it before applying the gunite. If it has been decided in the first place to use gunite over steel work, painting is not necessary. In fact, it will be better for many reasons to leave the steel unpainted, because gunite adheres better to unpainted steel. There is a chemical surface action between cement and steel which cannot take place if a coat of paint interferes.

Q.—Do the cement gun people recommend, or is there any decided tendency to use, coloring matter on coating old brick-work, for instance?

A.—That is entirely a matter of taste. It is very simple to apply a colored coat on such structures, and if anybody desires, for instance, to match up the work with brick buildings, etc., he can practically match any shade he may desire. Of course, coloring is a littl

Fig. 15—Deep rock cut on Erie R. R.

more expensive than ordinary work, but it has been done successfully in many instances.

Q.—I have in mind the case of the church in Evanston, where there was a variety of coloring on the face of the building shortly after it was coated. Could not that effect have been overcome if coloring matter had been used? Some of the discoloring has now disappeared, or at least has been very materially reduced.

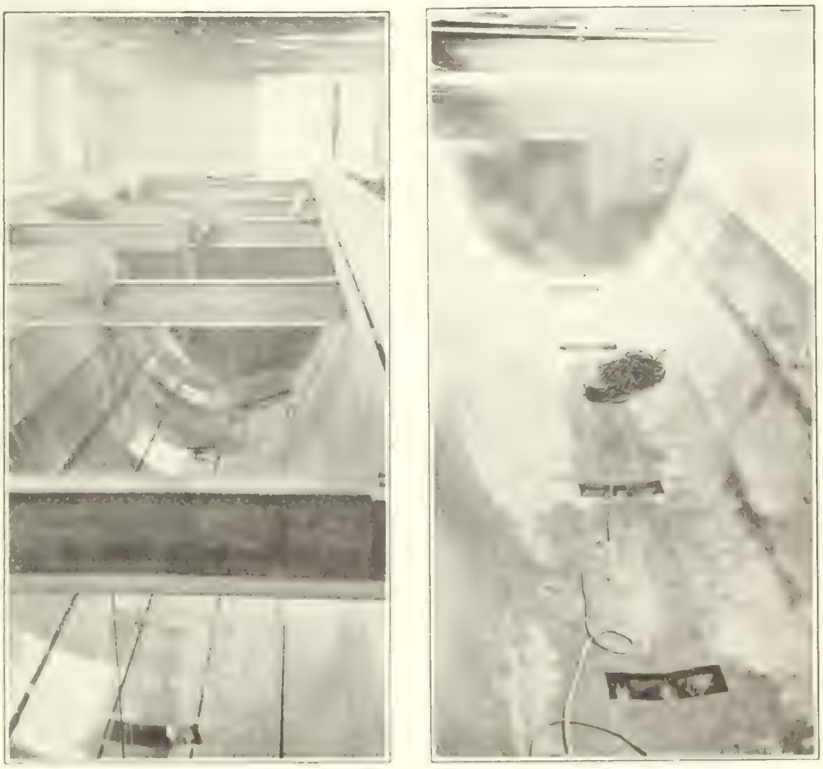
A.—The materials used on the Evanston church job were limestone screenings and cement. It seems as if limestone screenings and any other stone screenings have a greater tendency to discolor than ordinary sand. On a sand coating we seldom have any trouble from spotty coloring.

A Member.—I think a wrong impression might be had with reference to the coating of steel in the Woolworth building. I understand that the coating was put on as a fireproofing and was not necessarily intended to adhere to the steel, but was supported by a metal fabric cage. Possibly this explains why the paint was not cut off. Where the gunite is applied directly to a steel member and is held in place by adhesion, it is necessary, I believe, to clean the steel. We certainly would not want a film of paint intervening between the gunite and the steel. In reference to the waterproofing of a wall against water pressure with the head temporarily removed, this has been done very successfully. The material is so dense and the adhesion so perfect that it becomes part of the original structure. I have seen tests made where the gunite was placed on stone, hard-burned brick, or concrete, and then subjected to a test which would tend to develop the strength of the bond, and in every instance the band has developed as great strength as other parts of the mass. I am inclined to question whether or not the gun people have reached 100 per cent. efficiency; but whether they have or not is not material. We do know that the gun has great possibilities for certain lines of work, and it seems to me the principal thing is the work that it has been doing in repairing the poor work of someone else. We all regret that there is so much poor concrete work and we are equally glad to know that there is some way by which it can be repaired. I wish to ask what it would cost, ordinarily, to place an inch coat, say, on a horizontal surface and also on a vertical surface. On a vertical surface, metal fabric would be required, while on the horizontal surface it would not be needed.

A.—The question which the last speaker asks is a very hard one to answer directly, for the reason that so much depends upon the amount of work to be done in one place. We use a pretty heavy equipment, and to move that from place to place means expense. This is one portion of the cost. The material requirements for the gunite work are from 20 per cent. 25 per cent. more than handwork, owing to the loss by rebound and the additional density in the material. Therefore, it is very difficult to set a price and make this price stand out as something to go by. We have done work of this kind, 1 in. thick, as low as 70 to 80 cents a yard, while other jobs have run up to $1.50. That, of course, includes the reinforcement which has been used. Overhead work is a little more expensive than work on the side walls or work on the floor. If we figure on a job where different work is done in any quantity, it is all averaged and the average price taken. A 1 in. coating costs, on the average, about $1.00 per square yard. This average price may be used for rough estimating purposes. For actual practice, of course, the work has to be figured for every job according to the actual conditions.

Q.—What thickness of coating is necessary for steel protection? I refer to exposed work.

A.—As to exposed steel work—for bridges, etc.—I have before me the bulletin of the American Railway Engineering Association for January, 1914, in which a complete report is made by the committee on iron and steel structures for such work. I see from the drawings furnished by Mr. Tebbetts, bridge engineer of the Kansas Terminal Railway, that they apply 3 in. blasts. On a viaduct at Little Rock a 3 in. coating was also applied. I believe that such a heavy coat is not necessary, however; it seems to be the present-day practice to apply 3 in. on such bridges. If steel work is coated, on exposed surfaces in buildings where reinforcement is used 1½ in. to 2 in. should be sufficient; less than 1 in. should not be used in order to have some "body" in the mass. To get rust prevention without reinforcing, a ½-in. coat is all that is required, but there is always a certain amount of vibration, and there being no "body" in a thin coating, it would be more apt to loosen than if a coat with more stiffness in itself were used, with proper reinforcement. I believe 1½ in. is about the least we should apply to such steel work.



Figs. 16 and 17—Coal bunker at Michigan City, Ind., lined with Gunite.

Q.—Would it be possible to use gunite on the old Field Museum building in Jackson Park to restore it, and if so, could it be done at a reasonable cost?

A.—There is absolutely no question as to the feasibility of using gunite for the purpose mentioned, and at a cost less than that of any other process. As a matter of fact, the first cement gun was operated on the Field Museum. A light coat of gypsum stucco only was then applied, and at a later time the question was taken up of applying a permanent coating of gunite and transforming the structure into a permanent one.

Q.—The author has referred to the material being put on in coats. I would like to know if it is put on in one layer just complete going over a part and leaving it and then coming back and going over it until a sufficient thickness is obtained. Can you get a uniform thickness over a large surface with nothing except the eye to guide in producing it? Also, about what is the range of the gun at which one works? For instance, if you want to apply gunite to the under surface of a roof or the lower part of a bridge, for instance, a height of twenty or thirty feet, would it be necessary to put up scaffolding for such a distance?

A.—As to the first question, the material is seldom put on in one coating. In work where plain finish is required, it is necessary to go within, say, ¼ in. of the final thickness, then float it over and give the finishing coat afterwards. In bridge work, and work where the outside appearance, or rather the appearance of the work itself, is not of so great importance, the coating is, as a rule, put on in one coat and then a light flash coat is used to even up the very rough places. As to the height to which we shoot, it is desirable to keep the nozzle within three to five feet from the surface to be coated. Therefore, on the under side of the beams which are of a height, say, over eight feet from the ground, it is necessary to build a light scaffold to bring the nozzle within the proper distance from the work.

Q.—I would like to know whether this cement gun process would be applicable to the repair of a corrugated iron roof. The one I have in mind is made of twenty-gauge black iron, painted and badly corroded, and in places it is so badly rusted you can see through it. How thick a coat would be necessary to insure its being practically self-supporting on a three or four-foot span, where the members of the roof would be able to carry a new coating? Have you ever used it for such work?

A.—I am quite sure that the cement gun can repair the roof mentioned, and where the sun shines through and the metal in itself is not sufficient to act as a form, it would be comparatively easy to supply additional reinforcement. I believe that a coat of about 1½ in. to 2 in. thickness (depending upon the slope of the roof, the load applied, and several other things), is all that would be required to put this roof in good condition. It is in just such work that the cement gun is of the greatest advantage, practically such work as requires tearing down by any other process. The ability of the gun to go to most inaccessible places and avoid all this tearing down results in great savings.

Q.—Would there not be danger of the corrugated iron rusting out underneath, making it necessary for complete reinforcement?

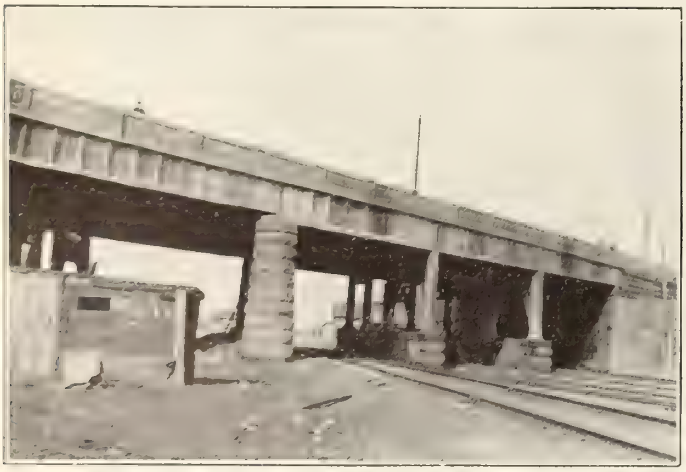


Fig. 18—New South High Street Viaduct, Columbus, Ohio

Fig. 19—Steel work, Woolworth Building, New York.

A.—We would use the corrugated old roof just for a form on which to place our material, providing reinforcing mesh in the new application. The present metal would be simply a form for the concrete work. If it rusts out, no harm is done, and at the same time this rusting could be counteracted to a certain extent by using a light coat, just for rust protection on the under side. This would also give the additional advantage of taking care of the condensation on the under side of the roofing by providing a rough surface.

Q.—How is the gun used on the Panama Canal?

A.—Variable use has been found for it, but the first and rather extensive use was had in the Culebra Cut, where the rock is of a very peculiar formation. There is a hard rock on top with an underlying stratum, which the torrential rains and exposure to atmosphere rapidly deteriorate. As this lower material deteriorated and crumbled down, it would undermine the hard rock lying above. It was found necessary to put some kind of a raincoat, as I might call it, over this mass to protect the material, and that is the first use to which the cement gun was put on the Panama Canal. Before they had a cement gun they used form work and applied ordinary concrete of a thickness of from 4 in. to 4 ft., due to the uneven slopes. With the cement gun, such a levelling was not necessary. There was no attempt made to produce an even surface, but simply to cover this, as it was uniformly 4 in. thick. Later the slides of the Culebra Cut destroyed practically all of this work.

Q.—It would not hold the slide back then?

A.—No, it was not expected to. The gun is also used on the Canal for finishing cement and other work as in ordinary practice.

A. Member:—The following two quotations from the report of the Geologist, appendix e, in the annual report of the Isthmian Canal Commission for 1912, may be of interest as giving the official reason for the lack of success attending the use of the cement gun under conditions for which it was not, as it turned out, particularly suited. Incidentally they may explain to the skeptical, how rock can oxidize.

"The rocks of the cut are mostly basic, and contain iron and magnesia compound in considerable amounts. The iron compounds are largely in the ferrous form and give to the rocks dark and green shades of coloring. On exposure to the moist atmosphere, these ferrous compounds are oxidized to the ferric condition, with change of volume and consequently a crumbling of the material so charged takes place. This, coupled with the soluble character of the limy cement present in varying quantities in most of the beds, seems to be the chief reason for the very rapid weathering here of all except the dense volcanic rocks. It is certain that no practical system of revetment work or retaining walls would prevent the large slides. Still there is no reason why a protecting revetment along the water's edge where the rocks are crumbly, designed to allow for the various adjustments, can not be adopted. A thin veneer of cement spread on the slopes from a cement spraying gun was tried, but without success. Within a few months the thin coat of cement thus put on began to crack and peel off, due to the following causes:

"(1) Oxygenated surface waters seeped through the thin coating and through the rock and oxidized the latter along its contact with the cement, thus causing the adhesive zone or contact to become loose and crumbly and very insecure.

"(2) Irregular swelling of the rock, due to oxidation, adjustment of pressures, etc., cracked the cement veneer and further weakened it.

"(3) Blasting vibrations tended to crack and scale it off."

It will be seen that this explanation applies to the places where the banks are unaffected by the slides. Naturally no one expected this cement coating to resist the pressure of the slides themselves, 4 in. is somewhat thin for a retaining wall for a sliding bank some 200 ft. high.

Q.—Do you lose any cement with the rebound of the sand? How do you try the pressure of the water and the aggregates at the same time? Do you take the city supply, or do you have air pressure behind the water?

A.—As to the first question, the loss of cement is ordinarily a negligible amount; in fact, it is such a small percentage that it does not need to be considered at all. For example, if you take, say, a baseball, or any hard body, roll it in the mud and throw it with very heavy force against a wall, the soft material will leave the ball and splash on to the wall surface. The same takes place on every grain of sand. The impelling force cleans the rebounding sand. Go over our cement work and you find the falling sand at the bottom is perfectly clean. In regard to the second question, it is necessary, of course, to have a higher pressure for the water than for the material. We need about 25 lb. more pressure in the water line than in the material discharge. There are many cases where the pressure in a city water system is 60, 65 and 70 lb.—quite sufficient for cement gun purposes. But if this is not the case, a pump is used in connection with the compressor.

Reinforced Concrete Factory Construction

There are two types of reinforced concrete factory construction—the one with outside bearing walls of concrete and few openings; the other, the skeleton type of construction, the walls being simply filling-in panels, built afterwards. It has been pointed out that the latter is the easier to build and the more economical, but that it calls for a consideration of the following points: The column and pilaster footings only need go down to a solid bearing unless an excavated basement is required. Where there is a basement, light walls reinforced horizontally from column to column, or vertically from the basement floor to the first floor, will retain the earth, the reactions being taken by the columns or by the basement and the first floor while the walls may be reinforced to carry themselves from footing to footing, requiring no foundation of their own.

Where there is no basement, the outside walls need only go far enough down to prevent frost working in under them, with possibly a shallow trench filled with cinders or gravel underneath. They can be reinforced to carry themselves from pier to pier to support the walls above. By building the footings first, and carefully filling, settling, and levelling the earth and laying the floor on the ground, the shores to support the falsework can be cut of even lengths, and there will be a good, level surface to shore from.

Keeping Reinforcement in Place

THE holding of reinforcing bars in proper position while concrete is being placed, is a matter which merits the utmost attention. The labors of the best designer and detailer can be set at naught by the carelessness of those in charge of the construction of reinforced concrete structures while placing steel and concrete.

A designer spends many days designing and detailing a complicated structure, the strength of which can be greatly impaired by comparatively slight displacement of the reinforcement at critical sections; yet the all-important matter of getting and keeping the bars in correct position is sometimes disposed of by a single note, such as the following: "All reinforcement to be bent and placed as shown on plans, and to be securely fastened or tied to prevent displacement during pouring of concrete and to insure proper position of reinforcement in the finished structure." It is left to the discretion of the construction foreman to devise a means of keeping the bars in position; and, as a result, the strength of the structure may depend on whether the foreman thoroughly understands his business or not.

This is neither good practice nor economy. The method and means of supporting reinforcing bars should be clearly indicated on the plans, since they are as important details as the location of bends of bars and stirrups. Where bars are bent up into the tops of slabs and beams, they are best supported by cross-bars resting on concrete blocks of a height to insure the exact location of bars. Bars in the bottoms of slabs can be kept at the proper height by small Z-shaped clips and spacing bars, to which the main bars are wired.

It is just as important to show the supporting bars, supporting blocks and clips, and the spacing bars, as it is to show the main reinforcement in detail. Before the structure can be built, it is necessary for someone to devise a means for keeping bars in position during construction; and as a general rule a good designer is more capable of handling these details to good advantage than anyone else. If it is left to the contractor, the owners pay dearly for this "designing service" rendered by the contractor if he is wide awake; and if he is not, he pays the bill. It can be seen at once that this is neither fair nor economical, and is very likely to lead to "wild" and "unbalanced" bids.

If a contractor is to bid intelligently and all contractors are to enter their bids on the same basis, it is imperative that these details be shown on the plans, when the work is at all complicated or important. The double purpose of keeping the bars in place and bringing more balanced and uniform bids, is fulfilled at once by including these supporting details.

The Efficient Operation of Water Purification Plants

By H. P. Letton*

SEVERAL interesting papers have recently appeared dealing with the operation of sewage disposal plants and emphasizing the necessity for more careful supervision of this kind of municipal work. It is well known to all who have investigated the matter that small sewage disposal plants receive as a rule little or no attention, and that their effluents could be greatly improved under proper operation. Discussion of these matters is therefore advantageous and desirable.

The writer was for some time previous to last July in the employ of the New Jersey State Board of Health, engaged mainly in the supervision of the public water supplies of the state. In connection with this work about thirty water purification plants have been visited upon numerous occasions. As a result of these visits, it became evident that the opinions that had been expressed in regard to the operation of sewage disposal plants were largely applicable to small water purification plants.

The main difference in the two cases is this: Sewage disposal plants are usually built, not because there is a concerted public demand for them, but for the eradication of a local nuisance, or by order of some higher authority. Because of this fact, and because the terms "sewage" and "sewage disposal" are distasteful to the average layman, the plant is generally put in an out-of-the-way place, and either forgotten entirely or placed in the charge of an underpaid, superannuated caretaker who knows nothing of the principles upon which the design of the plant is based; while a water purification plant is generally installed as a result of a popular demand and the consumer is directly interested in its operation in so far as furnishing a clear, colorless and palatable water is concerned. These are the qualities that to the majority of people determine the purity of the water, and as long as they are maintained there is little or no question as to the efficiency of the plant in other ways. As a matter of fact, however, there are many plants which will usually meet the above conditions but which are inefficient both from an economic and a sanitary standpoint.

It is only on rare occasions that a filtration plant has been constructed at the time of the installation of the waterworks system. In most cases, when the purification plant is added to an existing system, the operation of it is entrusted to the engineer of the old plant. This man may be, and in many cases is, a stationary engineer who thoroughly understands the operation of boilers, engines and pumps but who has absolutely no idea of the principles which underlie the process of water purification.

There is also another point which in many cases affects the results obtained. When it is decided that some form of purification is advisable in connection with a small water plant, it is very rare indeed that a consulting engineer is called in for advice. Instead, the matter is taken up with one or more companies engaged in the business of installing purification apparatus. While these companies are usually competent to give reliable advice, their main business is the selling of equipment. Because of this fact, and because the usual small water company or municipality is weak financially, the filter plant is designed to fit the available money, and the company offering the equipment for the least sum is generally given the contract, regardless of the quality of the material to be furnished. As a result of this practice, plants that are poorly designed, lacking in the necessary equipment for efficiency, or even wholly ill-adapted to the situation are commonly met with. A few cases of this kind which have come under the observation of the writer will be noted.

Inefficient Plants of Poor Design

Probably the worst example was at a plant supplying about a million gallons per day. The supply was originally obtained from artesian wells, but on account of the high iron content of the water a new supply was obtained from an artificial lake. This water was highly colored by its passage through cedar swamps. From the lake the water flowed by gravity to the coagulation basin. This was a rectangular wooden tank of such size that normally less than twenty minutes were allowed for coagulation and sedimentation. During periods of high consumption the time was considerably decreased. The basin was set at such an elevation that at times of low water in the lake it was impossible to obtain the normal supply except by by-passing some raw water. From the coagulation basin the water flowed by gravity to four rapid sand filters of the gravity, circular wooden tank type, without loss-of-head gauges or rate controllers. The agitating rakes were intended to be driven by a water motor, but the necessary power was lacking. The beds were therefore not agitated during washing. From the filters the water passed to a suction well which had been used in connection with the former well supply and which provided less than thirty minutes' storage. Two solution tanks had been provided and connected with a small displacement pump driven from the line shaft to which the main water pumps were attached. The small solution pump was intended to force a solution of sulphate of alumina into the raw water just before it entered the coagulation basin. At the time of the writer's first visit to this plant the chemical pump was out of order and no chemical was being added. It was afterward learned that this was its chronic condition. Tests of the raw water showed it to be slightly acid, owing probably to humic acid from the cedar swamps; consequently the addition of sulphate of alumina would be an absolute loss as far as results are concerned. Analyses of the raw and filtered water showed no material difference, and the filtered water had at times a color as high as two hundred.

While the foregoing may seem to be an extreme case, conditions almost as bad were found in several instances. Two other plants were discovered treating acid water with sulphate of alumina only; rate controllers and loss-of-head gauges were almost unknown; and the methods of regulating the amount of chemical applied were very crude. Few calibrated orifice boxes were found in use. Two gravity, rapid sand plants treating waters high in organic matter and often turbid had no coagulation basins; so that they required too frequent washing with corresponding reductions in bacterial efficiency as well as increased costs of operation. Another large plant, using the pressure type of filter, was treating a turbid water with very little time for coagulation. The effluent was frequently turbid, and at times continued aluminum hydrate. One plant of the slow sand type had less than a foot of filtering sand, and had a clear water well holding about a half hour's supply. As a result of this combination, the rate of filtration fluctuated exactly as the demand, and purification was practically nil.

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At one rapid sand plant the clear water basin was so small that it was necessary to wash with raw water. Another plant had no arrangement for filtering to waste, so that whenever it was necessary to get at the strainer system the dirty water in the bed was drained into the clear water well.

In the matter of operation, conditions were found to be as bad, if not worse. As has been said, the man in charge of a small water purification plant has usually little or no idea of the nature of the process. He operates the plant by "rule of thumb" methods in an endeavor to produce a good-looking water. Although efficient results depend so largely upon the use of the correct quantity of coagulant, the greatest ignorance of this matter was shown. At several plants the engineer stated that he put in a certain number of buckets of alum per day. He did not know how many pounds were used and made no attempt to add it in the same proportion at all times. A few engineers said that they increased the dose "some" when the water was turbid, but did not know how much. In only a few plants was any attempt made to regulate the dosage by the aid of alkalinity tests. At only two plants treating less than twenty million gallons per day were laboratories maintained, and at these plants the tests, both chemical and bacteriological, were made under the direction of non-resident chemists. The engineers who made the tests were unable to interpret them or apply them in the operation of the plants. At one modern municipal plant absolutely no records were kept. The chief engineer could neither read nor write and could see no use in records of any kind, not excepting pumpage records. The president of the board of water commissioners in charge of the plant stated that the only reason he could see for filtering water was to remove turbidity, notwithstanding the fact that the sewage of over a hundred thousand people was discharged into the river from which the supply was taken, about seventeen miles above the intake.

At one plant visited it was found that, through the laziness of the engineer, the filters were not being washed enough, the deficiency of water due to clogging being made up by by-passing raw water. At another plant the beds were washed too often, resulting in a low bacterial efficiency and a high cost of operation. Over ten per cent. of all water filtered was being used for wash water.

The most feasible remedy for poor design is a statute requiring the submission of plans for proposed plants or changes in existing plants to the state board of health or some other state authority for approval before construction can legally be carried out. Such a regulation is in effect in a number of states at the present time. Coupled with the appointment of a properly qualified engineer to pass upon all plans, it will satisfactorily care for new works. State supervision of existing plants will, if carried out, do much to remedy the more serious imperfections of construction and operation. This supervision cannot, however, be thorough enough to furnish definite information for the efficient operation of the plant both from an economic and a sanitary standpoint. At best the plant can be visited only about once a month, and this visit is merely to see that a safe and potable water is being produced. From the viewpoint of the state this result is sufficient, but from that of the consumer and taxpayer there are other matters of great importance. He wishes to know, first, that the water is healthful, and then that it is not possible to obtain the same or better results at a less cost by some change in the method of construction or operation of the plant. This latter is out of the field of the state inspector, for it generally requires much experimenting and testing to obtain the point of maximum efficiency.

The plan of having the engineer at the plant make daily tests under the general direction of a consultant at a distance is a step in advance, but it is far from perfect. The engineer's results are open to question since he is often hurried and makes the tests without knowing the reason for the various steps. Also, since he has but infrequent consultations with the consulting engineer or chemist and is unable in most cases to explain any seeming discrepancy in his results they do not prove to be of as much value as might be expected.

Advantages of a Central Laboratory

The writer has had in mind for some time a plan for remedying this situation, and it has recently again been brought to his attention by a similar plan which Prof. Earle B. Phelps has put into operation in connection with local health administration in several small Massachusetts towns. The plan is simply this: Let several water companies or municipalities, located not too far apart to combine forces, fit up a laboratory at some central point and employ a competent bacteriologist and chemist to give his entire time to the scientific supervision of their water plants. By so doing each plant would have the benefit of expert advice at a small cost. It would be possible for the chemist to visit each plant one or more days each week, and by so doing to become familiar with its operation. He could instruct the engineer in charge of the plant how to make the necessary daily chemical tests, such as alkalinity, turbidity, etc., and since he visited the plant so often these results could be checked up and would be reliable. In case of emergency he would be able to look after the sanitary quality of the water and thus protect the consumer. He would be able to carry on experiments upon the proper amount of coagulants to be used and time of coagulation. There is a chance for much study in the manner of washing the filters to bring about efficiency and economy. This is a point not considered much in small plants, but which has a considerable bearing on the cost of operation. It requires many visits to a plant to become familiar with its operation and to suggest changes which will increase its bacterial efficiency without increasing the cost.

Artesian wells have been discovered in the western portion of Steelton, Ont., and it is reported that 2½-in. pipes have been driven to a depth of 78 ft. and are supplying water estimated to measure 350 gals. a minute, 190 gals. in excess of the town's present consumption. The water is said to be so satisfactory that chlorination will be unnecessary, in which event the town will probably erect a pumping station and stand-pipe to control the supply.

A Process for the Utilization of Sewage Sludge

SEVERAL cities in California have recently had presented to them a proposition by a private company to not only dispose of their garbage without cost, but actually to pay the cities for the garbage delivered at the company's plant, and also to treat the sewage without expense to the city. According to the Municipal Journal, to whom we are indebted for these details, the company in question appears to have financial backing, and expressed its willingness to put itself under bonds to carry out this contract. Such a contract has been made with Los Angeles, and plans for the plant are now under way. A similar proposition was made to a combination of cities, with the idea that they should unite in a common intercepting and outfall sewer which would conduct the sewage to one disposal plant and, we understand, would arrange to have the garbage also all sent to a single plant.

The garbage disposal plant which the company making these propositions—the Pacific Reduction Company—proposes to employ is, we understand, to be modelled largely after the one which has been used successfully by the city of Cleveland for a number of years. More novel is the method by which the company proposes to treat the sewage. The plan in general may be described as follows:

Treatment of Sewage

The sewage passes first through a revolving elevating screen made of wire rope with angle iron separators, by which floating solids and large particles are removed and dumped onto a belt conveyor which carries them to a pulverizer, which redeposits them into the sewage. Provision is made for preventing the escape of odors from this portion of the plant. The sewage is then treated with chemicals (probably lime), and flows into a series of sedimentation tanks which are of sufficient size to give eight hours' retention in the tank and are divided into sections by baffle walls. The object of the baffles is to provide a thorough intermingling of chemical with the sewage and to prevent the formation of surface scum. Some special features are referred to, such as having the sewage, in flowing from the tank, pass over weirs in order to provide for absorption of oxygen from the air; the covering of the building "to protect the sewage from the influence of the sun's rays," etc. The effluent is to be further purified by some process not stated, although the electrolytic process is referred to. The sludge is drawn off from the sedimentation tanks to a pump well, from which a centrifugal pump delivers it to storage tanks. From these tanks it is drawn and forced into filter presses, presumably of the regulation type which have been used for years. During the pressing, steam is supplied for the purpose of releasing the grease, which flows off with the filter water and is collected in skimming tanks, the overflow from the tanks being returned for further treatment.

At this point the real novelty of the plan begins. The sludge is used for making producer gas, the process being described as follows: While the ordinary method of drying sludge has been to drive off the moisture as steam, driving off moisture does not require a temperature of 212 degrees Fahrenheit, but may be secured by subjecting it to large volumes of dry air at much lower temperatures, and much less heat is thus lost up the chimney. "The dryer is of the revolving type and partially enclosed in concrete walls lined with fire brick. Ample areas are provided for the circulation of heated air around the exterior and into the interior of the shell, so that the first value of heat is employed to heat the shell and the second value in heating the air which passes through the dryer in direct contact with the substance drying. The furnace and combustion chamber occupy the lower portion of the enclosed part. An arch extends from the furnace wall to the rear end of the combustion chamber, and the dryer is above the arch. Air inlets are located near the floor of the combustion chamber, and induced draft is developed by power fans, which produces the circulation and discharges the vapors into a condensing chamber. The gases enter the dryer at a temperature ranging between 1,000 and 1,200 degrees Fahrenheit. They follow the course of circulation, mingling and mixing with the air that is supplied to increase the volume, thus utilizing what would otherwise be discharged into the atmosphere. The second application of heat is at low temperatures, as the grease volatilizes at about 490 degrees Fahrenheit, and it can readily be seen how a safe maximum temperature can be maintained by increasing or decreasing the volume of air by controlling the speed of the blower.

"The dry residual matter is deposited by the dryer into a boot of an elevator, which delivers it into storage bins situated above the gas producers." In the condensing chamber referred to, which is connected with the dryer, are baffle walls which cause the gases to pass in a gyratory manner and atomizers which produce a water spray passing downward through the chamber. "The vapors which leave the dryer contain grease, ammonia and carbon dioxide; the heavier are thrown down by a spray, collected and delivered to the storage vats by a pump. The grease is removed and the liquor discharged into the sewage tanks. The light or uncondensed gases are either consumed under the boiler or in the gas producers; or they can be discharged into the atmosphere, as they have been thoroughly cleansed.

"The character of the sludge has undergone a great change by the previous treatment and is converted into fuel, the thermal value being equal to many lignites, tan bark, or sawdust, an ideal material for fuel for a gas producer. The thermal value of sludge was early recognized, but the large percentage of ash prevented its use as fuel for the production of gas. The solution to this problem has been made by the type of gas producers, which are of the revolving hearth type and automatic in action. The mechanism is so designed as to have positive control of the ash discharged. Automatic feed supplies the producer with such amounts of fuel as correspond with the fuel consumption per square foot of grate surface. The gas flows from the producers into the washers, where the impurities are removed, and continues on to the holder." (Part of this gas is used for supplying the heat employed in the dryer.) "The gas washers are of the centrifugal type, known as the Feld washer. These washers have given splendid service in England and Germany, and have been adopted as being the most efficient." Ammonia is recovered as a sulphate at a point between the gas washers and the holder, while the gas is in transit. The ashes from the gas producer are said by the company to form an excellent base for fertilizer.

New Water Supply for Winnipeg

Preliminary work for the new water supply for the City of Winnipeg is going on satisfactorily. The supply is to be obtained from the Lake of the Woods. Advantage has been taken of the frozen ground to make accurate surveys and locate the line approximately on the preliminary alignment through a country almost impenetrable except in winter. A section 37 miles long has been run between two points 38 miles apart, with a deviation of not more than 3 miles from the air line and with a perfectly uniform grade of 0.7 ft. per thousand except for two small river crossings.

The location is through a country about 60 per cent of which is covered with small timber. Half the distance is in muskegs. The concrete aqueduct will be uniformly covered by a fill 4 ft. deep, and it is believed that the invert will at all points be in hard ground below the swampy stratum. A contract of about $1,000,000 has already been awarded for the construction of 96 miles of standard-gage service track for the construction of the pipe line. This track will be built in accordance with standard specifications and will have 60-lb. rail on rock or gravel ballast, qualifying it for permanent service. Construction has already been started on a $15,000 telephone line connecting the engineering and construction camps with the offices in Winnipeg. Mr. James H. Fuertes, of New York City, is the consulting engineer.

New Sewage Disposal Plant in Worcester, England

THE new plant for the bacterial treatment of the sewage of the city of Worcester, England, is now complete. The works have cost, in capital expenditure, quite $500,000; the repayment of loan and interest, covering a period of 30 years, will exceed $30,000 yearly, and the running expenses will amount to $10,000 a year, thus involving a rate of at least 10 pence in the pound. The author of the scheme is T. Caink, the city engineer.

The sewage from the city proper is conveyed under the River Severn by means of a tunnel, at a point where it used to be turned into the stream. That from the suburbs on the western bank, which used to enter the river close to Worcester bridge, is now diverted through meadows to a junction with the deep level sewer connected with the tunnel, and thus the whole of the city sewage is conveyed to the works at Bromwich-lane. After passing through a screening chamber it goes to the detritus well, 84 feet deep, where the heavy inorganic solids fall by gravitation to the mouth of sluice lifts devised by T. Caink which bring them to the surface for disposal. It is then passed to the primary pumps, one delivering 2,000,000 gallons daily and the other 6,000,000 gallons a day, and which is used for lifting storm water when the quantity flowing along the sewers exceeds the capacity of the other pumps.

The primary pumps discharge the sewage into a series of chambers containing gravel disintegrating screens, and thence it is returned to the engine house, where it is raised by secondary pumps into the distributing tower. From the tower it is sent into a series of six rotating sprinklers, of the Candy-Caink type, and distributed over the primary bacterial filters. The latter are six in number, circular in form, 200 feet in diameter and 8 feet deep (of fine gravel). The beds are underdrained by drain pipes and tiles laid radially from the centers to effluent channels which encircle the beds near their circumference. Each filter is surrounded by a number of vertical air shafts, which communicate with the effluent channel. From the channel the air passes along the under-drain, and upwards, taking the reverse course to that followed by the liquid. The sprinklers run upon rails carried upon arched concrete tracks, and are said to be the largest successful self-propelled sprinklers in the world. After passing through the beds the liquid is taken to a series of sand filters 3 feet deep on a layer of gravel a foot deep and is finally discharged into the effluent channel in cascades, which assist, it is believed, in oxygenating it before it flows into the river.

Rerolled Reinforcing Bars Tested

TESTS in the laboratory of Purdue University, Lafayette, Ind., are stated to have proved conclusively that steel reinforcing bars for concrete construction rerolled from old steel rails may be safely used in such work. About 1,000 samples of bars were tested which had been collected from five mills in several States. The samples were taken at different times and under various conditions so as to represent the average output of the mills. The difference between the bars rolled at the several mills was found to be comparatively small. The general tendency shown in these tests was toward a decrease in strength and an increase in the elongation as the size of the bars increased. A part of this general tendency was considered to be due to the fact that a portion of the larger sizes treated were twisted bars. The tests showed that the straight round bar was the strongest and the twisted bar the weakest of the design commonly used. According to Dr. W. K. Hatt, head of the department of civil engineering, under whose direction the tests were conducted, the largest bar which should be used should not be more than 1 in. in diameter. The round bar was found to be more efficient if it had small ribs on the surface, serving to give a better hold in the concrete.

Building an Eighty-Five ft. Chimney in Seven Days

This quite unusual feat was recently accomplished by a St. Louis construction firm. The chimney was built on the company's system of reinforced tile concrete with a reinforced concrete foundation. The company informs us that the chimney was actually built, including its foundation, in seven days' working time and was completed and put in service just 16 days after the receipt of the order. During its construction there occurred, moreover, the heaviest snowfall recorded in ten years in St. Louis, and the temperatures were at no time higher than 20 degrees F. when work was started in the morning. The sand was heated before mixing and the tile was heated before placing. Fires were kept in the chimney constantly with all openings closed. The chimney has a total height of 85 feet and is three feet in inside diameter.

A tunnel under the Danube is planned by the Roumanian Government to form a connection with its newly acquired territory. A bridge was first considered, but as no protected site was to be found, military precautions forced the abandonment of the project. The proposed tunnel will have heavily fortified terminals.

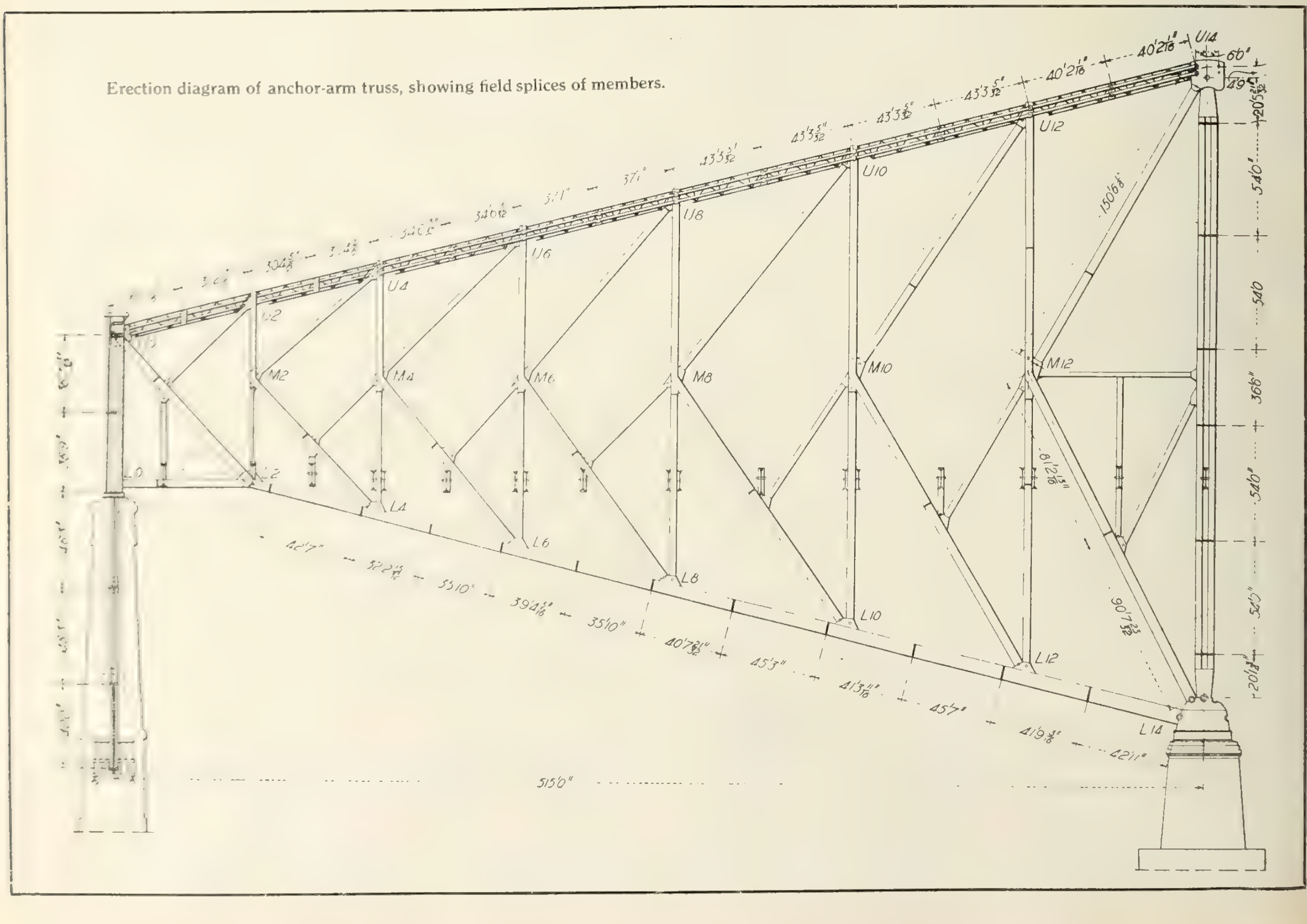
The Quebec Bridge Anchor-Arm Spans

Important Developments in Main Trusses, Bracing, Twin Tension and Compression Members, Multiple-Pin Connections and Field-Spliced Shipping Units

IMPORTANT modifications in both type and details of long span steel-bridge construction have been developed in the 2,830-ft. double-track Quebec Bridge. Many of them appear in the anchor arms and are described in this article. The type of main-truss bracing is special. The usual top lateral system is eliminated. The extraordinary dimensions and great weight of the truss members necessitate shipping some of them in sections, afterward united by field splices to make the panel units. Auxiliary trusses have been provided to support long flexible members, main panel-point connections have been made with multiple pins, and special connection pieces have been introduced at important panel points. Transverse and longitudinal girders in the floor system have dimensions comparable with large plate-girder spans. Deep transverse latticed traction girders have been introduced between the trusses in diagonal planes.

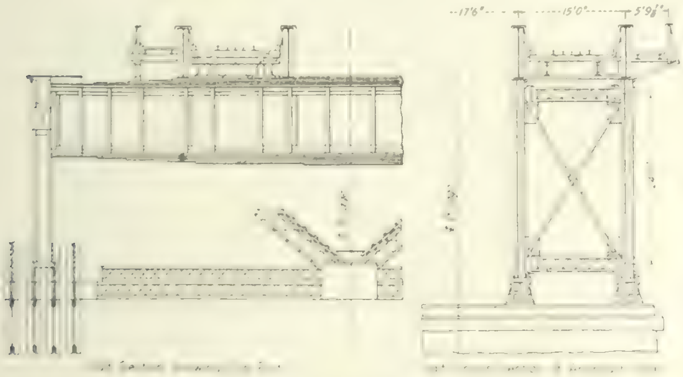
The anchor-arm spans, each 515 ft. long and 310 ft. deep on centers at the main posts, have two pin-connected trusses 88 ft. apart, and weigh 16,600 tons each, exclusive of the steel in the anchor piers, but inclusive of the 2,700-ton main vertical posts and their 900-ton bearings, which are common members in them and in the cantilever arms. The trusses are each proportioned for a live load of two E-60 locomotives followed, preceded or followed and preceded by a train load of 5,000 lb. per linear foot. They are made entirely of carbon steel, with the exception of the end diagonals L_2U_0 and the connection details at L_2 and at U_{14}, which are made of nickel steel.

The web members of the trusses are arranged to make a K-shaped type of bracing, and all carry both dead and live loads, except the horizontal members in the center of the panels adjacent to the main posts on the cantilever side, and the trusses supporting the top-chord eyebars. The chords are in straight lines. None of the principal stresses are indeterminate. The long double-hop-chord eyebars are supported at the center of each panel on special lattice girders connected to the tops of the vertical posts. The 7 x 10-ft. bottom chords are made of four built I-beam ribs laced together, and with horizontal bracing on the center line, the webs being held in place by transverse diaphragms. The principal compression members have intermediate field-riveted transverse splices, and in some of them the sections between these splices are made of two pieces shipped separately. All web members are made up of plates and angles and are pin-connected at their intersections. At the main panel points the web members are connected by pins through gusset plates riveted to the bottom chords,


Erection diagram of anchor-arm truss, showing field splices of members.

independent connections being thus provided for each member.

Some of these features are of special interest in comparison with the 500-ft. anchor-arm spans of the original Quebec Bridge. The trusses of the latter were 315 ft. high and 57 ft. apart and weighed 6,250 tons for each span, exclusive of the 700-ton floor system. Both top and bottom chords were parabolic curves, and the trusses were divided into 100-ft. main panels and 50-ft. sub-panels. The types of truss, secondary bracing systems, top-chord and web-member design and floor system conformed in general to standards for ordinarily long spans. The bottom chords were made of four built channels having their flanges connected by tieplates and lattice angles. They were about 4½ ft. deep and 5½ ft. wide, with a maximum cross-sectional area of 776 sq. in., as compared with a maximum area of 1,902 sq. in. in the present structure. The heaviest chord piece, 65½ ft. long, weighed 165,000 lb.



Part sectional elevations of anchor-arm and end spans.

Secondary Bracing and End Anchorage

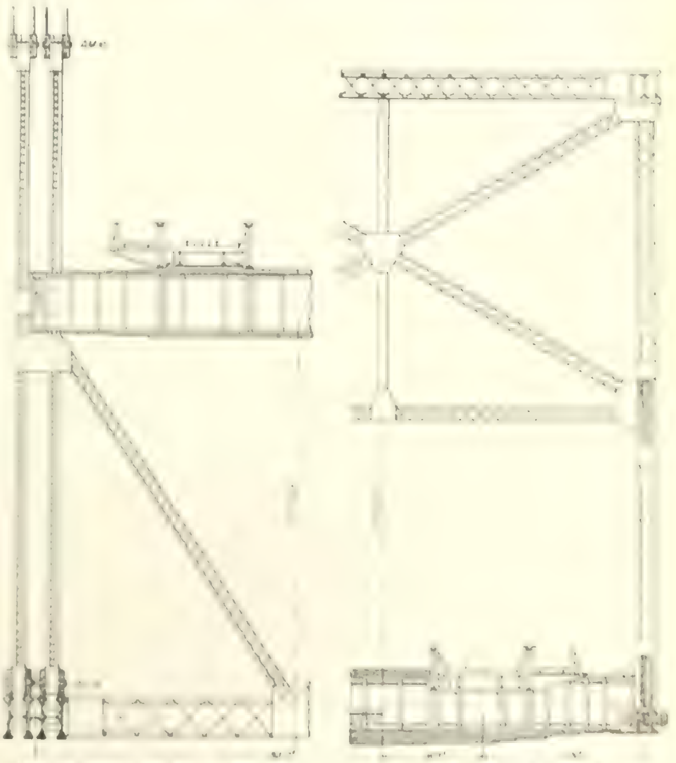
The system of transverse bracing in the anchor and cantilever arms of the present bridge is unusual in that it does not require top laterals. The trusses are connected by transverse sway bracing in the planes of the upper sections of the vertical members and in the lower sections of the inclined members, thus transmitting all transverse stresses directly to the X braced bottom lateral system in the plane of the lower chords. There are horizontal transverse braces at the top and bottom chord panel points which, like the diagonals and bottom laterals, have rectangular cross-sections made of four large corner angles latticed together with diagonal angles. All of the bottom lateral diagonals are tapered to correspond with the varying depth of the lower chord.

As all floorbeams are located at a considerable height above the bottom chords, the vertical transverse panels under them are braced by diagonal struts reaching from the ends of the floorbeams to the centers of the bottom horizontal transverse struts. The diagonal braces between the upper parts of the vertical posts are connected at their intersections to short vertical members supporting the horizontal transverse struts below them.

The upper part of the masonry in the shore pier, together with the structural steel inclosed in it, is designed to resist a maximum vertical uplift assumed to be 8,000,000 lb. for each truss under extreme conditions. This is provided for by two sets of vertical eyebars connected to the ends of the top chords at U [illegible]. These eyebars have a combined length of about 206 ft. from their connection with the truss to their connection with the reaction girders. Of this distance 89½ ft. are in an open well in the masonry, which, added to 77 ft. from the top of the masonry to the top of the truss, gives a length of 165½ ft. that is free to move longitudinally in accordance with temperature expansion without disturbing the 40-ft. lower section of bars concreted solidly in position. The lower ends of the anchor eyebars are pin-connected to transverse distributing girders, forming part of the reaction platform, built into the lower part of the pier masonry.

The bridge has a clear height of 150 ft. above extreme high water. The floor is level on the center span and has a 1-per cent. grade on the anchor and cantilever arms. The lower chord is level with the floor at the anchor piers and about 110 ft. below it at the river piers. The floorbeams are therefore connected to the trusses in relatively different positions, which govern their type and the manner of connection. At panel points L_1 and L_2, nearest the anchor pier, the floorbeams are field-riveted through connection angles. Floorbeam L_1 supported by a riveted vertical member pin-connected to the end diagonal U_0 L_2. Floorbeam L_2 is connected to the lower chord. All other floorbeams are connected to the web members of the trusses by 11-in. pins in 15-in. steel bushings.

At the main panel points 4, 6, 8, 10 and 12 the double floorbeams are made of duplicate girders, one on each side of the vertical hangers, to which they are connected by a common pin. At the main vertical post L_{14}-U_{14} the floorbeam is a single-web girder in the center plane of the post and passes between the duplicate halves of the post, being connected to them by a single pin at each end. The remaining floorbeams at the intermediate panel points 3, 5, 7, 9, 11 and 13 are single-web girders connected to short vertical members from the intersections of the main and sub-diagonals in each panel. At the shore end of the span the floorbeams are located below the intersections of the sub-diagonals and the vertical tension members. At the river end the floorbeams are above their inter-



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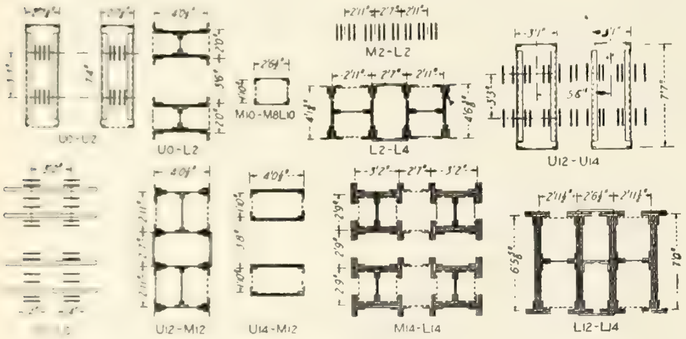
sections and the sub-verticals are compression members with pin connections to the diagonals.

The bridge is designed and constructed subject to the approval of the Board of Engineers, consisting of C. N. Monsarrat, chairman and chief engineer, and Ralph Modjeski and C. C. Schneider. It is being fabricated and erected by the St. Lawrence Bridge Company, Limited, of which Phelps Johnson is president; G. H. Duggan, chief engineer; W. P. Ladd, shop superintendent; G. F. Porter, engineer of construction; S. P. Mitchell, consulting engineer of erection, and W. B. Fortune, erection superintendent.

Important Features of the New Quebec Bridge

The design of the new Quebec Bridge, as was expected, embodies not only a number of important features developed in the largest spans previously built but also some new ones of a radical character. This statement applies to both the main 1,800-ft. span and to the 515-ft. anchor arms.

In the general truss design, the K-shape bracing has important advantages in distributing the shear between two members in each panel, thereby reducing the sizes of the members, simplifying the connections and facilitating field assembling. A decided advantage in erection, too, is found in the very interesting departure of providing separate pins for the connections of different members at main panel points, a feature which, of course, also improves the fabricating details. Shopwork is further facilitated by the use of straight instead of curved chords, with the necessary consequence of right-angle joints in the compression members.



Typical cross-sections of principal anchor-arm truss members.

In the center span and cantilever arms, where weight reduction was important, the selection of nickel-steel for many members was to be expected. In the anchor arm the connection of the vertical anchor bars to the top chords increased the length of the latter, providing better for longitudinal temperature movement, and possibly reducing secondary stresses.

The eye-bar arrangement in the chords is especially worthy on note. The bars, some of which are 85 ft. long, are supported intermediately by special lattice girders. The excessive stresses in the pins, had the usual method been followed, and the difficulty of packing and of assembling the numerous bars in each panel are overcome by placing them in two tiers with double pin connections to the vertical posts.

On account of the part played by the lower-chord design in the previous structure, the section adopted for the new bridge is of special interest. It consists of four deep webs, latticed top and bottom, and having horizontal plate diaphragms on the longitudinal center line.

The secondary stresses and difficult connections, due to the riveted joints at the ends of the enormous single and double-web floorbeams, have been avoided by pin-connecting them to the vertical members. Symmetrical loading is obtained by placing the double webs between the double webs of the hangers. All pins subject to turning have full-length bushings. All transverse forces have been concentrated in the planes of the lower chords by the elimination of the top chord lateral system and by the combination of vertical and inclined sway-braced system transmitting the horizontal forces directly to the bottom-chord panel points.

These and other special features indicate the substantial progress that has been made in this design and suggest the direction in which future advances will be made.

Day Labor and Contract

"Saving the contractor's profit" by carrying out a municipal undertaking by day labor is often an expensive proceeding, comments Engineering and Contracting. A Pacific Coast city projecting extensive harbor developments began deepening the waterway with a municipally operated dredge. The result was unsatisfactory; in fact, it is stated that a good part of the fund was used up before the dredging had scarcely been started. The same city also undertook to construct a bridge by day labor. It is reported that this structure cost $50,000 more than it would if the work had been done by contract. These unfortunate happenings have had one good effect, for the advisory committee in charge of improving the water system has recommended that this improvement be carried out by contract. Experience is a good teacher; so is common sense. By a judicious use of the latter almost any city councilman should be able to see the fallacy of the day labor system of doing public work.

One of the more recent apartment operations in the city of Chicago affords a fair illustration of the way modern builders and architects are treating the housing question. It in reality is four separate buildings occupying an area 150 feet square and will contain 15 apartments of from five to ten rooms, each suite having an individual sun parlor, sleeping porch and a bath attached to every bedroom. The buildings which surround a terraced court centered with a fountain, have an underground tunnel for service and public utility piping. The architecture is in the English Tudor style, the facades being dark red brick with terra cotta trimmings topped by a roof of harmoniously colored slate.

The chief of architecture of the Panama-Pacific International Exposition has approved the design for the Grand Trunk's building, and construction will proceed immediately. This is the first of the Canadian buildings to be erected, and sets the general style for the whole Canadian group. It will contain 10,000 feet of floor space and will be occupied by an extensive and valuable exhibition of Canada's resources. Its location is in one of the best parts of the exposition grounds, and the style of architecture will be that of the Spanish renaissance.

Powder charges used in grading work on the Canadian Northern Railway in British Columbia are said to have given best results when varied from a minimum of ½ lb. of powder per cubic yard of shale to a maximum of 1½ lb. per cubic yard of hardest country rock.

The C. P. R. Terminal Improvements at Vancouver

The Canadian Pacific Railway Company's terminal improvements at Vancouver, B.C., are rapidly nearing completion. It will be recalled that the general scheme embraced a passenger station and office building located on land immediately east of the present passenger station. Another dock, 200 x 490 ft., has been built. A particular point of interest in this work was the use of piles 135 ft. long on the pier end. The main entrance to the station is located on Cordova street, with the main waiting room on the street level. Tracks are located about 25 ft. below this level and there is provision for four passenger tracks separated by wide platforms. Stairways and lift connect the two levels of the station and a separate footbridge is carried over the passenger tracks and is directly connected with the waiting room at one end and with the stairways leading to the track level, thus giving access to the platforms without crossing the tracks at grade.

In order to avoid a grade crossing and the consequent delays to traffic between the city and the piers a steel viaduct is being built on the line of Granville and Burrard streets, passing over the tracks to the piers. An incline is also being built on the west side of the Granville street viaduct to the wharf, thus giving access to the lower deck of the pier and freight sheds and to the water-front.

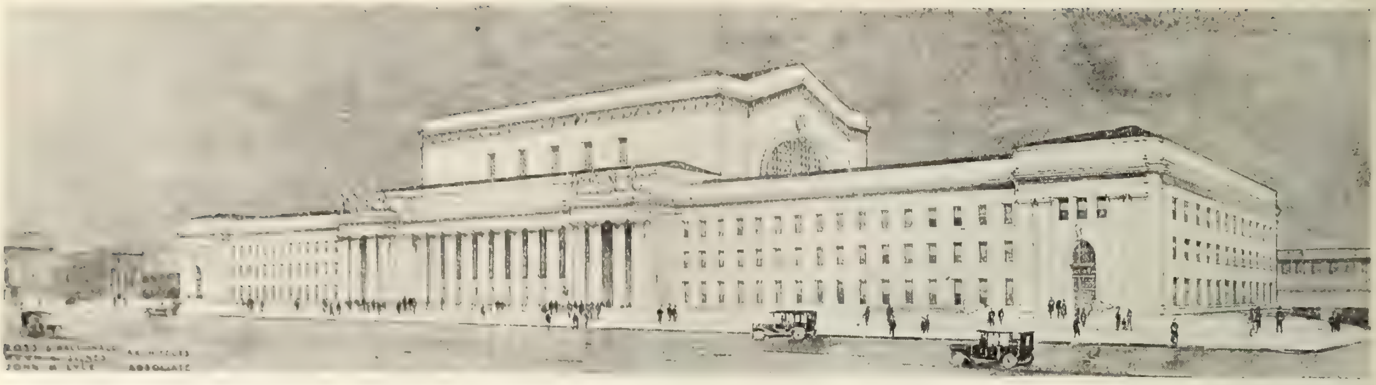
The passenger station is a combination stone and brick structure with a steel frame. The station is divided into two principal levels on the lower of which are the baggage, mail and express rooms while on the upper are the ticket offices and waiting rooms. Above the public rooms in the station the space will be devoted to the general offices of the railroad company. The interior arrangement of the office space will be on the unit system and each unit will have complete heating and lighting facilities with partitions that may be readily installed or removed as changes in the arrangement of office accommodations become necessary.

The principal problem was to provide easy and economic communication between the city, the railroad station and the piers, these last introducing an element which is unusual in most railroad terminals so far as passenger traffic is concerned.

It is expected that the station will be ready for occupancy during the summer and that the steamship facilities will be available somewhat earlier, although, owing to the necessity of removing the old station before the viaduct can be built on the extension of Granville street, the use of the present grade crossing over the freight yard tracks will have to be maintained for a month or two longer.

Messrs. Barrett, Blackader & Webster, of Montreal, are the architects for this work. Westinghouse, Church, Kerr & Company, of Montreal, are the engineers for the complete design, construction and equipment of the terminal, working in co-operation with the officials of the Canadian Pacific Railway.

The first Canadian and International Good Roads Congress, to be held in Montreal from May 18 to 23 promises to be one of the most successful in the history of the Association. Several hundred delegates are expected to attend and between forty and fifty of the manufacturers of road-building materials and machinery will exhibit samples of their products in the arena. Speakers of note from several provinces in Canada, the United States and European countries will be present, and the Congress will be officially opened by the Lieutenant-Governor of Quebec, Sir Francis Laugeler. Mr. Lehman, Engineer to the French Government, will deliver a lecture on "Continental Highway



Toronto's Proposed New Union Station

THE Grand Trunk and Canadian Pacific Railways entered into an agreement rather more than a year ago to form a Terminal Company for the purpose of erecting and operating a Union Station at Toronto. The Terminal Company appointed as its Consulting Engineers, Mr. H. R. Safford, Chief Engineer of the Grand Trunk, and Mr. J. M. R. Fairbairn, Assistant Chief Engineer of the Canadian Pacific, with Mr. J. R. W. Ambrose, Engineer of Grade Separation, as Chief Engineer of the Terminal. Messrs. Ross & Macdonald and Hugh G. Jones received the appointment as architects to design and supervise the construction of this work. Subsequently they appointed as their local associate Mr. John M. Lyle, of Toronto.

The architects were instructed by the Board of Engineers of the Terminal Company to study the traffic problem at Toronto in all its aspects and peculiarities, and, without dictation from either Road to design a station which would adequately meet the needs of the passenger traffic of the city and provide for the large growth of traffic indicated by the growth of population of the city and surrounding districts during recent years. They have been working faithfully and continuously on the problem for the past ten months and have collected and tabulated all of the traffic data of the station covering the past twenty years, so far as procurable. They have also made extended inspection trips, visiting all of the larger terminals in America and have obtained from these terminals the amount of traffic being handled by them. This information has all been compiled in tables, which furnish a scientific basis for the design of the new station for Toronto.

The architects' recommendations are contained in an exhaustive report presented to the Engineering Board of the Terminal Company and this report has been thoroughly discussed by the representatives of the two railroads.

This report shows the passenger traffic to be equal to that of Washington, D.C., and to be half that of St. Louis or Kansas City. The baggage business is, however, surprisingly heavy, being equal to that of the Pennsylvania Station, New York, and almost as great as that of St. Louis Station, Boston South Station and Grand Central Station, New York. The parcel business bears nearly the same relation, it being equal to that of the Pennsylvania Station, New York, but is somewhat less than the Grand Central Station, South Station, Boston, Kansas City or St. Louis Stations. The fact is brought out that the average number of pieces of baggage or parcels per passenger is greater at Toronto than at any large station on the continent, so far as records are obtainable.

The character of traffic handled at the St. Louis, Washington and Kansas City Union Stations is similar to that at Toronto. These stations handle a heavy through and local business with heavy maximum periods occurring during certain seasons of the year. The arrangements of these stations and the relation of their present traffic to the areas provided have been very helpful in regard to the requirements for Toronto.

In considering the design of the station, it was found that the average normal traffic at Toronto could be taken care of by a station building of somewhat smaller dimensions than the one proposed, but it is in consideration of the heavy maximum periods such as Exhibition time, June and Christmas holidays, with their attendant crowding and discomfort, which have influenced the architects in recommending the construction of a building large enough to afford a complete separation of entrance and exit traffic during heavy periods and for the time when the traffic of the station has grown to demand it. This principle of the complete separation of traffic and the method proposed for accomplishing it has been accepted by the two roads interested, and is obtained through the utilization of conditions of the site and the relation of track levels to the street. This idea of complete separation of traffic is the dominating one in the design of the station. There has been no station constructed with a similar object in view where it can be so completely accomplished as is contemplated for Toronto and we can therefore recite no parallel case. The Grand Central Station in New York provides separation of express and suburban traffic on two levels, the inbound and outbound express traffic being further separated through the provision of additional separate station buildings. The Pennsylvania Station, New York, provides a separate exit concourse, but the arrangements are such as to make the meeting of friends difficult. The new Kansas City Station provides separation until the Ticket Lobby is reached.

It so happens at Toronto that the elevation of Front Street above the present track level affords an opportunity for placing a Train Waiting Room at a level midway between the street level and the proposed Exit Concourse beneath the Ticket Lobby. This arrangement approximately averages the distances which entrance and exit passengers have to travel and does away with all confusion and crowding and unsatisfactory arrangements for meeting friends, which have been borne by the public in the past. The great advantage to the travelling public will become immediately apparent to anyone who will analyze the operation of the station designed under these conditions. The passengers on entering the station to take trains will enter a large Ticket Lobby approximately 90 ft. wide by 250 ft. long. In this lobby within plain sight are placed all of the general business facilities of the station. In the centre of the room is the Information Bureau; on one of the long sides the Ticket Offices to the number of 20; at one end of the Ticket Lobby is the Restaurant and at the other end the General Waiting Room. Opposite the Ticket Offices are the Parcel Checking Counter and the Baggage Checking Counter, each with a frontage of 50 ft. These are separated by a 40 ft. entrance passage to the Train Waiting Room. Owing to the elevation of the railroad tracks above the street level, this room is placed beneath the tracks. Similar rooms are provided in the new Michigan Central Station at Detroit and the new Union Station at Winnipeg, though these are much smaller than the one proposed for Toronto. The Train Waiting Room is reached by passing down a broad easy ramp in the entrance passage from the Ticket Lobby. As the stairs to trains lead directly out of this room from either side, it will naturally be a gathering place for passengers after they have completed their business in the Ticket Lobby. This room, though limited in height by the elevation of the tracks, will be 100 ft. by 250 ft. and will be made attractive through the use of light colored, durable materials, such as marble and glazed terra cotta.

Passengers arriving on trains will descend separate exit stairs leading from the train platforms to separate exit concourses placed each side of and flanking the Train Waiting Room. For passengers who wish to transfer to trains on other tracks, provision is made to pass them through to the Train Waiting Room. Passengers wishing to exit from the station will follow along the exit passages, and during light traffic will pass into the ends of the Ticket Lobby where they may meet their friends, transact their business and exit to the street or to cabs.

The difference in levels between the exit passages and the Ticket Lobby makes possible the provision of easy ramps from the exit passages to an exit concourse placed beneath the Ticket Lobby. During heavy periods exit passengers will pass through this exit concourse, which, except for the Ticket Offices, is practically a duplicate of the Ticket Lobby above, and exit passengers will find all of the facilities required by them within easy access. The Information Counter is in the centre of the room and Parcel Checking and Baggage Claim counters are provided in locations similar to and directly beneath those of the Ticket Lobby. The advantages of this arrangement for passengers are that the business capacity of the station is practically doubled and the transaction of passengers' business will be greatly facilitated through the absence of the interference of entering passengers. In the same manner, passengers hurrying to trains will not be hampered by crowds of exiting passengers wishing to use the facilities of the station. The arrangements for meeting friends are ideal, in that there will be but one point where all passengers can be met, irrespective of the direction from which they arrive. It is expected that checked hand baggage can be delivered to passengers in a much shorter time and passengers having to pass baggage through the Customs will find the Customs offices close at hand. Provision is made for cab service adjoining the exit concourse.

Provisions for handling the enormous baggage and mail business in the station are made in the space beneath the Train Viaduct, with direct communication by elevators to all the train platforms. The building is to be fitted with every modern convenience for the traveller and we believe whether operating under light or heavy traffic, the travelling public will be able to transact its business without congestion or confusion at any time.

The exterior of the building has been designed in an adaptation of Roman classic architecture, and it is the intention to secure a beautiful and dignified effect through the use of plain and simple wall surfaces and the sparing use of ornament, which becomes dingy and dirty in a few years on a building of this character. The interior of the Ticket Lobby will be of similar style to harmonize with the exterior.

The architects and railroad officials have given extended study to all of the conditions entering into the traffic problem of Toronto and the plans prepared will afford real relief to the travelling public and will provide facilities for the traffic for many years to come. We believe that the station when completed and operated as outlined above, should provide the best and most conveniently arranged building of its kind on the Continent. The plans are now being completed and should be ready for the reception of tenders within a few weeks.

Proposed Union Station, Toronto. Main Booking Office.

Ten concrete-road essentials were given by Mr. Ernest McCullough, consulting engineer, of Chicago, in a paper presented at a recent meeting of the Illinois Society of Engineers and Surveyors. These are as follows: (1) Intelligent supervision, (2) careful selection of materials, (3) proper proportioning, (4) proper mixing, using batch mixers only, (5) moderate use of water, (6) avoidance of a mix leaner than 1:2:3, (7) use of reinforcing on wide roads and over filled spots, (8) use of combination metal and fiber expansion joint fillers at intervals of about 25 ft. across the road, (9) avoidance of longitudinal joints, and (10) a visit to some concrete road under construction before attempting to construct one.

The Union Construction Company, [illegible] Sydney, N.S., have the contract for a 12-mile stretch of railroad for the Department of Railways and Canals. The contract was obtained for $360,000.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

Owing to the scarcity of work, the painters of Montreal have decided not to strike for higher wages, as they threatened to do.

Oxford County Council is commencing work on a Good Roads scheme in Woodstock, Ont., which will involve an outlay of about $320,000.

The York County Highway Commissioners, for whom Mr. E. A. James, Toronto, is the Engineer, contemplate the expenditure of $150,000 on road work this season. The plans now await government approval.

At a special meeting of Granby Council a resolution was passed in favor of procuring the services of a competent hydraulic engineer to consult with in regard to contemplated improvements in the water supply system.

The first consignment of Pyrites ore to be received this year arrived at Fort William a few days ago over the G. T. P., and consisted of nineteen cars. The Pyrites ore is mined between Fort William and Superior Junction.

The contract has been awarded to Mr. John Putherbough for the erection of a chapel and an addition to a hospital at London, Ont., the contract price being $125,000. The building will be of white brick construction. The architects are Messrs. Watt & Blackwell.

Reports are current that Mr. C. P. McLennan, of Halifax, N.S., is in London, Eng., promoting an English company for the manufacture of railway locomotives at Fort William. The capital of this Anglo-Canadian Company, it is stated, will be £1,000,000, of which £400,000 will shortly be issued in England.

A programme of street improvements for Fort William has been endorsed by the City Council to the extent of about $600,000. Of this amount over $175,0000 will be spent in paving, $84,000 in macadamizing, and the balance on gravelling roads and streets, sewers, sidewalks, and improvements generally.

Burlington Council has been notified by the Government that plans have been prepared for extensive improvements to the harbor. A cement pier will be constructed 150 ft. out, and a breakwater will also be built. The present wooden piers will be replaced by cement cribs sunk to support the new ones.

The contract for the 66,000 volt transmission line, 30 miles long, of the Cedars Rapids, P.Q., Manufacturing and Power Company, has been let. The Canadian Allis-Chalmers, Limited, have secured the order for the steel poles and the Northern Aluminum Company, Shawinigan Falls, will supply the wire.

The contract for section 4A of the new Welland Ship Canal has been awarded to Messrs. MacGuire & Cameron, the contract price being slightly under $84,000. This contract is not in the original lay-out of the canal proper, but is being made to form a connecting link between the old canal and the channel now in course of excavation.

Consequent on the opening up of Longueuil, P.Q., by the erection of the large Armstrong-Whitworth plant, the contract for which was carried out by Mr. E. G. M. Cape, the council have decided to expend $83,000 on improvements. Plans for paving, sidewalks, etc., have been prepared by Mr. A. Ste. Marie, town engineer.

Mr. John E. Conley of Memphis, Tenn., President of the Conley Frog and Switch Works, arrived at the head of the lakes a few days ago to make preparations for the building of a Frog and Switch Plant, situated between Fort William and Port Arthur. Mr. Conley states that work on the construction of the plant will begin almost immediately.

The Interprovincial Brick Company of Canada, Limited, who are erecting a plant for the manufacture of pressed brick near Cheltenham, Ont., have opened head offices in the Goodyear Building, Toronto. Mr. F. B. McFarren, the general manager, was formerly purchasing agent for Mackenzie, Mann & Company, on the Montreal tunnel and terminus contract.

Building permits issued in Fort William since January 1 to the middle of April totalled in value $549,850, of which permits amounting to $118,100 were issued in January; $128,350 in February; $138,750 in March and from April 1 to 23, $164,650. Permits for the two theatres which are to be erected this summer by the Fort William Opera Company have not yet been taken out.

King's County is to have the first Good Roads association in the province of Nova Scotia. The object of the association is to disseminate information regarding the construction and maintenance of good roads, and to increase public interest in road making. Legislative power will be asked for so as to allow of the acceptance of either local or federal aid, or both, for the purpose of demonstrative work.

Writing to the Ontario Board of Works recently Chief Justice Sir William Meredith objected to the policy adopted by the Board in regard to the proposal to turn the effluent from the contemplated North Toronto sewage disposal plant into the Don River. Sir William declares that should the city persist in carrying out its intentions he will appeal to the Attorney-General for proceedings to restrain the city from doing so.

At the annual meeting of the Canadian Club, Mr. E. H. Bennett, the architect who has been chosen by the Dominion Government to prepare plans for the development and beautification of Ottawa and Hull, gave an interesting address in which he traced the progress of city planning from Ancient Rome to the Paris of the 18th Century, and down to the present day. In industrial planning he strongly favored federal districts.

York Highway Commission has been notified by the Ontario Government that road improvement can be proceeded with according to the programme for 1913, an Order-in Council having been passed for the appropriation of $100,000, the understanding being that the city should contribute $100,000, a similar amount to be provided by the Government and the county. There is still about $200,000 available for Good Roads work in Ontario.

Mr. E. G. M. Cape, head of the company which is building the new sugar refinery at St. John, N.B., expects to have the plant running before the end of the present summer.

His company also has the contract for the concrete face and surface of three new wharves at West St. John, these to be finished in time for next winter's business. The timber substructure is being erected by Mr. D. C. Clark, contractor, whose men will work day and night during the next few months.

Mayor Hocken and Works Commissioner Harris have returned to Toronto from Atlanta, Ga., where they had been inspecting a sewage disposal plant of the type which it is proposed to construct in the Don Valley section of Toronto. Mr. Harris announces that the Atlanta system has proved entirely satisfactory. The plant consists of three Imhoff tanks, of which one has been in operation for twenty months, and the people of Atlanta are fully satisfied regarding the success of the Imhoff method.

The Advisory Industrial Committee, Toronto, have passed a vote of confidence in the architects of the new Technical School at present in course of construction, and an expression of perfect satisfaction with the work so far done on the building. The matter arose out of a letter received from the architects, Messrs. Ross & Macdonald, requesting the committee to take definite action to remove existing irritation brought about as the result of charges made by one of the trustees, alleging faulty workmanship against the architects and contractors.

The contracting firm of Edward F. and Gilbert E. Farquier, of Ottawa, obtained judgment a few days ago for $5,315 in an action against Mr. John King, a Fort William contractor. The parties were sub-contractors for the construction of certain sections of the National Transcontinental Railway west of Cochrane, Ont. The plaintiffs claimed from the defendant $8,833 for transportation of supplies, workmen, etc., for their section of the road; also for gravel supplied, hire of freight cars and work done. The defendant set up a counterclaim which was disallowed.

The interesting statement was made a few days ago when passing through Toronto by Mr. W. B. Fitzsimons, Industrial Commissioner of the Grand Trunk Railway, that the large clay manufacturers of the United States are being attracted by the rapid growth of Toronto. He further stated that since the beginning of April he had secured six large clay products corporations which were contemplating the erection of plants in the vicinity of Toronto, and that he anticipated several other manufacturing companies would also open branches in the province before the end of the month.

The year 1913 was a bad one for the building industry and a considerable decrease in the brick business for the year had been anticipated. Those anticipations were realized as far as the National Brick Company of La Prairie, P.Q., were concerned. From the report made at the last annual meeting it was learned that there had been a decrease in the gross earnings of 22 per cent. In his report the President, Mr. J. N. Greenshields, remarked on the fact that although the year opened with a great demand for bricks, subsequent inactivity in the building sphere was reflected in a decline of new designs. The chief factor offsetting the decrease in sales, however, was the high efficiency and low cost of production secured by the company's organization and manufacturing plant. The new Delson plant has exceeded all anticipations with regard to economical production and the operation of this plant in conjunction with the La Prairie works is said to have resulted in many economies at both places.

A unique building has been erected at Ottawa and will be used for the purpose of standardizing the Dominion land surveyors' tapes. The building is 18 ft. wide by 150 ft. deep. To obtain the required uniformity regarding weather and temperature five thicknesses of brick were laid in the walls, leaving an inch air space between the sheeting. This sheeting is banked by 18 inches of shavings. Then there is another sheeting of tar paper and 4 inches air space, and a further sheeting, making 4 ft. walls. Another aid to the maintenance of the desired temperature is a system of electric driven fans circulating the air within the building. An idea of the fineness of the work accomplished by the standardization instrument may be gained from the fact that it is possible to measure within one twenty-five thousandth part of an inch. The instrument is so arranged that it works on a series of cement piers, each placed four meters apart, with the exception of those set at a standard distance for testing regulation tapes.

WESTERN CANADA

During the present season, upwards of $1,500,000 will be expended on over a hundred road-making and improving gangs in Saskatchewan.

Work is to start at once on the building of thirty residences, at a cost of about $120,000, at Medicine Hat, Alta. Mr. R. F. Beachey is the architect and general contractor.

Mr. F. S. Cahill, a prominent citizen of Saskatoon, Sask., has offered cash prizes for the most artistic gardens and city blocks. The competition will be handled by the City Parks Board.

A permit has been issued for the erection of an apartment block at Winnipeg to cost $100,000. Mr. H. Genser, of Winnipeg, is the architect and general contractor. The building will be of stone and concrete foundation and brick construction.

An Ottawa syndicate has applied for a 20-year franchise in connection with the proposed street railway system for Prince Albert, Sask., at an estimated cost of $250,000. The syndicate has entered into further negotiations with the city on the subject.

Work has been commenced on the new sewerage system for Esquimalt, B.C., by the contractor, Mr. Hugh Macdonald. The work is being done in sections and the engineer, Mr. C. H. Topp, has plans practically completed for the letting of the contract for another section.

Winnipeg is likely next year to have one of the finest club houses on the North American continent. It will be known as the Winnipeg Athletic Club, and will be fourteen storeys high. With equipment the structure will involve an outlay of $750,000. It is to be ready for occupation in 1915.

Work is in progress on the construction of a business block at Edmonton, on which the sum of $450,000 is to be expended. The structure will be of ten storeys, and of terra cotta and pressed brick construction. Messrs. Olson & Johnson are the general contractors. The architect is Mr. J. K. Daw.

At Calgary, Alta., a storage elevator estimated to cost $1,250,000, is to be erected by the Dominion Government. Tenders for the work will be received by the Secretary of the Department of Public Works, at Ottawa, Mr. R. C. Desrochers, until June 1. Plans and specifications may be seen at the office of the Chief Engineer of Grain Commissioners, at Saskatoon.

Tenders have been called for a new Technical High School, to be erected at Medicine Hat, Alta., at a cost of $300,000. The building will be of brick, stone, fireproof and concrete construction, and bids will be received by the secretary-treasurer, Mr. James L. McCallum, until June 1, for the general contract, particulars of which may be obtained from the architects, Messrs. McCoy & Levine.

Work will start immediately on the construction of a new filtration plant at Edmonton, Alta., on which it is pro-

[illegible] to expend $175,000. The capacity of the plant will be [illegible] gal. which with the present clear water basin will be sufficient to meet the requirements of a population of more than a quarter of a million.

Tenders will be called immediately for excavation work in connection with the erection of a new hotel in Victoria, B.C. Plans for the new structure have been revised by Mr. Rexford, architect, which provide for the construction of [illegible] substantial main structure, together with a power house, a laundry and an administration hall.

Construction has been started upon a new building at Medicine Hat for a Radiator factory, to be operated by Mr. [illegible] Wright. The contracts have been let for 260,000 brick, 315,000 sq. yds. of roofing and 130,000 ft. of lumber. Mr. Wright considers the prospects very promising for the output of the factory, as nothing of this nature is manufactured in Canada west of Toronto.

The contractors, Messrs. Navin Brothers, expect to have work completed within a month on the new armoury which the Government is erecting at Moose Jaw, Sask., at a cost of $400,000. The building is composed of red brick and white Tyndall stone, with castellated battlements over the main entrance in the centre of the front facade. The front elevation is [illegible] ft. in length and the depth of the building is 141 ft.

The electric light and power house station at Regina, Sask., which the contractors expect to complete before the autumn, is being built on the north shores of Wascana Lake. When finished it will cost in the neighborhood of $450,000. The new power house will be 218 ft. by 170 ft., covering an area of 28,000 sq. ft., and will be three storeys in height over basement. It will be 68 ft. high and will contain about 800 yds. of structural steel. The building will be of pressed brick and stone construction and the roof of thick concrete and felt. One of the features will be a complete absence of smoke, although the plant will have a battery of sixteen boilers and a generating capacity of 8,000 h.p.

Vernon, B.C., city council has accepted the recommendation of Messrs. Tummins & Agnew, consulting engineers, as to the best methods of bringing Vernon's sewage disposal works up to the requirements of the Provincial Board of Health. One method suggested by the engineers for making the system efficient was to enlarge considerably the disposal works so as to take care of the total flow. The alternative was a lesser addition to the disposal works and the construction of an under-drainage system to carry off the ground water at present seeping into the sewers, and to control the surface water at the same time. The engineers have been instructed to submit detailed plans for the enlargement of the disposal works and the carrying out of the under-drainage system, the work to be done in sections.

Although building operations throughout the west have been somewhat backward this year, there is no want of evidence that Regina will be well in the foreground regarding the extent of the building programme for 1914. Contracts are already in sight which will bring the total up to approximately $5,000,000. This will include the erection of several important public buildings, business blocks, apartment houses and high-class residences, some of which are already under construction. Among the works mapped out for the present season are the Grand Trunk Pacific hotel and station, the ladies' residence, and two towers, at Regina College, the co-operative elevator building, a new power house, police station, provincial jail, armouries and customs buildings for the Dominion Government, nurses' home and wing to General Hospital, new theatre, flour mill and new Government House. Tenders have already been called for the addition to Regina College, which will involve an outlay of about $100,000, while the two towers will cost in the neighborhood of $80,000. Work has been re-started on the G. T. P. hotel and depot, the latest plans for which call for an expenditure of close on $2,000,000. The hotel will be twelve storeys in height, of steel and stone construction, and will be finished in the same style as the Fort Garry Hotel in Winnipeg. There is also an extensive programme in view of civic improvements, such as pavements, waterworks and sewers, light and power extensions and street railway construction.

It is announced that the contract will shortly be let for the construction of the proposed dry dock at Esquimalt, B.C. The dimensions of the dock, the site of which will be the north side of Lang's Cove, will be:—length from caisson stop to head wall, 1,150 ft.; width of entries, 120 ft.; depth on sill at ordinary high-water spring tides, 40 ft.; width at coping of back walls, 144 ft. The section near the entries measures 500 ft. in length and the one further east 650 ft. By this arrangement there are virtually two docks in which small ships can be conveniently handled, either in couples or singly. Each part will be closed by steel caissons. The dock will be emptied by three centrifugal pumps, each having a capacity of 60,000 gal. per minute. The pumps and other machinery will be operated by electric power generated by the dock power plant. After the rock excavation the construction of the walls will be commenced. These will be built of concrete, with granite copings and alters. All keel and bilge blocks will rest on granite strips extending the full length of the dock, and granite will be used for caisson stops. On the south side a basin will be formed to allow of repairs while vessels are afloat, and to unload cargoes from vessels before entering. The structure round the basin will be built of reinforced concrete piles, and reinforced concrete will be the material used on the construction of the extensive frontage of wharves. The Dominion Government appropriation of 1914-15 will be available for the work, which when completed will be one of the finest undertakings in Canada.

Canadian Railroad Development

Construction has been resumed on the Lake Erie and Northern Railway, and operations will be continued as far as Brantford.

As a result of a protest from the Ontario and Dominion Sewer Pipe Companies against a rate of 2 cents per 100 lbs. on the carriage of clay between Waterdown, Mimico and Swansea, the Dominion Railway Commissioners have reduced the rate to 1½ cents per 100 lbs.

The heavy grades on the Intercolonial Railroad between Sydney, N.S., and Moncton, N.B., are to be eliminated subject to the approval of the Minister of Railways. This reduction of grade would mean a saving of 25 per cent. in operating expenses, and the company contend that the tonnage as a result of the change could be doubled by increasing the strength of the approaches.

With the completion of the Grand Trunk Pacific branch now under construction from Regina to Northgate, the port of entry on the international boundary, it will be possible for passengers to board a train at Chicago and proceed without interruption to Prince Rupert. By completion of the branch to Northgate the G. T. P. will be given an entrance to St. Paul over the Great Northern tracks.

The Dominion Railway Commissioners have been approached by Mr. M. K. Cowan, K.C., on behalf of the Milton Pressed Brick Company, who complained that the C. P. R. had failed to lay the tracks as anticipated by the Brick Company when double-tracking the line between Guelph Junction and Toronto. The Brick Company applied to have the tracks removed to enable them to increase the yard area, but this the Railway Board declined to accede to.

A report from Edmonton states that more than $10,000,000 will be expended by the C. N. R. on construction work in Alberta during 1914. The Onaway North-West line to Pine River Pass, which is guaranteed for one hundred miles at $20,000 a mile, is well advanced, thirty-two miles of steel having been laid and the remainder of the work will be completed this year. The government is stated to have insisted on the construction this year of the line from Little Bow, south of Calgary, to Macleod which road is guaranteed at $15,000 a mile.

A deputation from Northern Ontario waited on the Provincial Government a few days ago with the object of urging the construction of the Elk Lake branch of the Temiskaming & Northern Ontario Railway from its present terminus to Gowganda and thence to Sudbury. Replying on behalf of the government, Hon. W. H. Hearst stated that he was unable to promise how soon the line would be constructed. For some time the government, through the railroad company, had been investigating the possibilities of the district and endeavoring to find a location that would be practicable both as an engineering and a commercial proposition.

The new section of the Lacombe and Blind-man Valley Railway from Lacombe to ten miles west of Gull Lake, Alta., is expected to be opened for traffic on July 15. This railway is the first to secure assistance in accordance with the recent legislation by which the province guarantees the bonds of lines building into territories not already opened up by steam roads. Other companies are said to be anxious to take advantage of the new law, and extensive building of light railways in Alberta is looked for in the near future. The total length of the new line will be about thirty miles. The road is being built of standard gauge with steel sufficiently heavy for large locomotives.

Messrs. Armstrong & Morrison, of Vancouver, have commenced the driving of piles at Pitt River and will shortly move the section of the old steel spans from the present railroad bridge in preparation for the construction of the new double-track traffic bridge across that waterway. Steel work on the new bridge commenced some weeks ago, the contractors for the work being the Dominion Bridge Company. The piers for the structure are now completed. The steel trusses will be placed west of the draw span, and the draw itself will be of the usual swing pattern. The superintendent of the Dominion Bridge Company, Mr. J. Findlay, expects to have the work completed next October.

Several Montreal architects have removed to new addresses, as under: Brown & Vallance, Southam Building, Bleury Street; Saxe & Archibald, Royal Bank Chambers, Dorchester Street and Beaver Hall Hill; Nobbs & Hyde, Old Birks Building; Doucet & Morissette, Dandurand Building, St. Catherine and St. Denis Streets; and Benoit & Girard, Southam Building.

The Asphalt & Supply Company, Limited, Montreal, have removed to 107-108 Board of Trade Building, Montreal.

In order to secure increased facilities for their business, Messrs. Archibald and Brotherhood have removed from the Herald Building to the Southam Building, 128 Bleury Street, Montreal.

Mr. P. A. N. Seurot read a paper on Subaqueous Tunnelling at a general meeting of the Canadian Society of Civil Engineers on the 23rd ult. The paper is a compendium of interesting facts about this class of engineering and of observations recorded by the writer while engaged on the construction of important subaqueous tunnels in America and Europe.

Personal Mention

Mr. G. H. Archibald, of St. Catharines, has been appointed City Engineer of Saskatoon.

Mr. George Hogarth, Assistant Engineer, Department of Public Works, Ontario, has also been elected a member of this body.

Mr. James C. Morton has accepted a position as superintendent of the National Paving & Contracting Company's Regina branch.

Mr. J. W. Evans has been appointed City Engineer of Belleville. Mr. Evans is president of the Tivani Steel Company, Belleville.

Mr. George W. Lee has been selected to succeed Mr. Fred Dane on the Temiskaming & Northern Ontario Railway Commission.

Mr. F. A. Dallyn, C.E., provincial sanitary engineer of Ontario, has been elected to membership in the American Waterworks Association.

Mr. E. I. Sifton, consulting hydro-electric engineer, of Hamilton, Ont., has been appointed manager of the hydro-electric plant of Hamilton.

Mr. James L. Dusfield, of the firm of Mackenzie, Mann & Company, of Montreal, has been elected an associate member of the Institution of Civil Engineers.

Mr. J. A. Wickett, Toronto, died April 26 following an attack of heart failure. He was a well-known masonry contractor, and was born in Belleville in 1858.

The death took place recently of Mr. Geo. H. Waring, President and Managing-Director for many years of the Union Foundry & Machine Works, Limited, of St. John, N.B.

Mr. C. C. Mendham, who has been connected with the outdoor staff in Toronto of the Herbert Morris Crane & Hoist Company, Limited, has now been appointed Resident Engineer in Berlin for the same company.

Mr. M. H. Baker, formerly city engineer of Prince Albert, Sask., is at present associated with the Surveys Branch Department of the Interior on the survey of roads and townsites in the Rocky Mountains near Banff.

Mr. Robert C. Muir has been appointed to the staff of Mr. W. A. MacLean, Provincial Highways Engineer for the Ontario Department of Public Works. Mr. Muir until recently was associated with the firm of Mackenzie, Mann & Company.

Mr. S. B. Wass, chief engineer of the Quebec Extension Railroad, has been appointed Assistant chief engineer of the St. John's (Quebec) Railway, a proposed line 174 miles long and extending from Quebec Province to the State of Maine.

Mr. Alexander Allaire, Western Manager of the Foundation Company, Limited, Vancouver, was elected to membership of the American Society of Civil Engineers recently. Mr. W. F. Hicks, superintendent of Operation and Maintenance Department of Natural Resources, C. P. R., Lethbridge, Alta., has been elected to Associate Membership of the same body.

Canadian and International Good Roads Congress—Montreal, May 18-23, 1914.

Golden-Anderson Patent Cushioned Controlling Altitude Valve

A valve which should meet with favor where conditions are such that the amount of water in a water tank is automatically regulated, especially in regions where the regulator is liable to freeze, is the Golden-Anderson Patent Cushioned Controlling Altitude Valve which is designed to operate under varying pressures. If the valve is placed in a pit under the tank, or any conveniently accessible place, and is protected from freezing weather, it insures a water supply at all times.

The illustration shows the main valve closed. The operation is as follows: With the main valve closed, if water is drawn from the tank, standpipe or reservoir, the pressure is removed from the top of the diaphragm "R," causing the valve-spindle "K" to rise, which allows the high-pressure auxiliary valve "H" to close and the exhaust valve "I" to open, permitting the water above the piston or valve "B" to escape through "M" and "N." As the pressure above the valve is removed, the pressure under the valve "B" forces it open. The water above the valve acts as a cushion in opening, and, at the same time, as the valve begins to travel upward it draws air in through the port "F," in the side of the body, to cushion the valve when closing.

The water in the tank having reached a predetermined height, the pressure entering through the small pipe "T" is distributed on the top of the diaphragm "R" causing the valve spindle "K" to close the auxiliary valve "H," thus allowing the pressure to come on top of the valve "B" through the ports "L" and "M." Owing to the greater area being on top of the valve "B," it is forced to its seat, thereby shutting off all water. This action of the main valve "B" brings the air cushion into operation, compressing the air and forcing it out through the port "F," thus preventing shock in closing.

The Altitude valves will work both ways, maintaining the water level in tanks, standpipes or reservoirs, on a single supply and discharge line, and allow the water to flow back through the valves for distribution whenever the pressure is less on the inlet side of the Altitude valve.

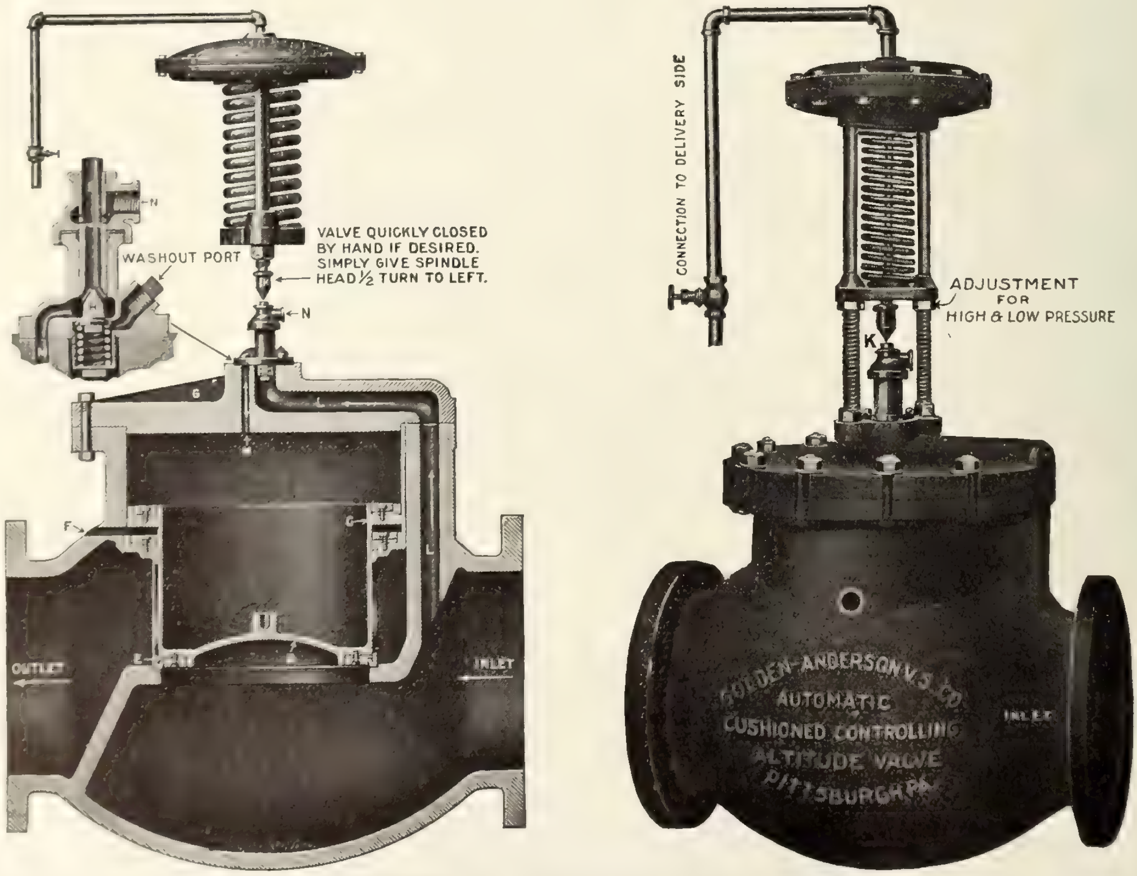
The valves are so constructed that electrical appliances can be attached quickly, so that the valve can be closed at any time by throwing an electric switch in contact at the pumping station or as many different places as desired. By using this valve so arranged there are two ways of closing, viz., by water and electricity. This is especially important in case of fire.

The Montreal Builders' Exchange have removed from the Eastern Townships Bank Building to the Victoria Building, Victoria Square.

Messrs. Chadwick & Beckett, architects, Toronto, have removed their office from 18 Toronto Street to more commodious quarters over the new Bank of Nova Scotia Building, 130 Church Street.

Mr. W. G. Hunt, architect, formerly of 935 Bloor Street West, Toronto, has opened offices at 244 Confederation Life Building, and has taken into partnership Mr. A. H. Woodburn, late of the City Architect's Department.

A pamphlet devoted to steam and power pumps manufactured by the Gray Manufacturing and Machine Company, Limited, Toronto, is illuminating as to the advanced design and high grade workmanship. The publication is bulletin No. 12, and communications respecting it should be addressed to the firm at 686-692 St. Clarens Avenue.


WASHOUT PORT
N
VALVE QUICKLY CLOSED BY HAND IF DESIRED. SIMPLY GIVE SPINDLE HEAD ½ TURN TO LEFT.
N
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CONNECTION TO DELIVERY SIDE
ADJUSTMENT FOR HIGH & LOW PRESSURE
K
GOLDEN-ANDERSON V. S. CO.
AUTOMATIC
CUSHIONED CONTROLLING
ALTITUDE VALVE
PITTSBURGH PA.
INLET

Golden-Anderson patent cushioned controlling altitude valves.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brandon, Man.
The city council has approved the paving of Rosser Ave., from 12th to 1th St. and Princess. from 1st to 6th Sts. The work is to start at once.

Bobcaygeon, Ont.
The village council has under consideration the laying of granolithic sidewalks at a cost of $10,000.

Carleton Place, Ont.
Tenders in connection with the construction of the waterworks and sewage disposal plant will be received by the town clerk, R. G. Peden, until 6 p.m. May 18th, for (2) furnishing materials for and constructing pump house and intake pipe; (3) furnishing materials for and constructing a sewage disposal plant. Plans are at the offices of the consulting engineers, T. Aird Murray & Lowes, 186 King St. W., Toronto, and the Town Engineer.

Chatham, Ont.
The city council, Clerk W. G. Merritt, proposes to lay sidewalks on Poplar, Cornhill, St. George, King, Delaware, Adelaide, Richmond, Prince and Park Sts., and Pop Alley, and sewers in Forest Sts., and Stanley, Patteson and Inshes Avenues.

Calgary, Alta.
Tenders will be received by the city council until May 18th, for the supply of cast iron pipe. Specifications are at the offices of A. W. E. Fawkes, waterworks engineer and the city engineer, Geo. W. Craig.

Tenders will be received by the city council until June 1st, for the supply of steel water pipe. Specifications are at the Waterworks Dept., City Hall.

Eastview, Ont.
Tenders for the laying of concrete sidewalks on four streets will be received by the Clerk, H. Washington, until May 6. Plans and specifications are at the office of the engineers in charge, Patterson & Byrne, Sparks St., Ottawa

Hamilton, Ont.
The laying of asphalt pavement on Cannon St. E., is contemplated by the city council. Engineer, A. F. Macallum.

Humboldt, Sask.
The town council is considering the laying of 5 ft. cement walks and crossings on Main, Livingston, Cumming, Stanley and Milton Sts., and Kane, Franklin, Cabot, Railway, 1st, 2nd and 3rd Avenues.

London, Ont.
Tenders for waterworks supplies will be received by the city council until May 21st. Engineer in charge, H. J. Glaubitz.

Mortlack, Sask.
Permission has been granted by the Prov. Govt. to raise the sum of $2,300 for street grading, $2,200 for plank sidewalks and $2,000 for fire protection.

Moose Jaw, Sask.
The City Council will probably construct sidewalks on Saskatchewan, Willow, Hall, Alberta, Algoma, 15th, 16th and 10th streets. The estimated cost is $60,000.

Montreal, Que.
Tenders will be received by the Board of City Commrs., until noon May 8th, for the construction of sewers in Emard ward (main sewer), Belmore Ave., St. James St., Sherbrooke St., Mayfair Ave., West Hill Ave., Wilson Ave. and Old Orchard Ave. Plans and specifications are at the office of the Engineer, Supt. of Sewers.

Montreal, Que., St. Laurent
Plans and specifications for the construction of permanent sidewalks are at the office of the Sec.-Treas., C. S. Tasse, who will receive tenders until 7 p.m. May 15th.

Niagara Falls, Ont.
Tenders will be called shortly by the City Council for the laying of about 56,1 000 square yards of brick pavement. Engineer, F. J. Anderson, City Hall.

New Westminster, B.C.
The city engineer has been instructed to call for tenders for the paving of McInnes and 8th Streets with stone setts.

Ottawa, Ont.
The city council is considering the laying of wood block pavement on Murray street between Dalhousie and Cumberland streets. The proposal has been passed by the Board of Control.

Surveys have been made for the laying of asphalt pavements on York St. The Board of Control has signfied its approval.

The city council proposes to lay pavement on Broad St. between Albert St. and end of the street; on Clarence St., between Charlotte and Wurtemburg Sts. City Engineer, Arch. Currie, City Hall.

Plympton Twp., Ont.
The laying of tile drains is being considered by the Twp. Council. Township clerk, Thos. [illegible], Wyoming, Ont.

Quebec, Que.
Tenders will be received by the Waterworks Engineer, J. Gallagher, City Hall, until 4 p.m. May 12th, for the supply of 630 tons cast iron pipes, 4-in. to 14-in. in diameter and 6 tons of specials, more or less. The pipes are to be delivered free on cars or wharf in the city, before July 1st.

Regina, Sask.
Tenders will be received by the City Commrs. until noon July 1st, for the construction of 113,000 sq. yds. pavement. Plans and specifications are at the office of the Engineer, F. McArthur.

Tenders will be received by the City Commrs. until noon May 25th, for the construction of storm and domestic sewers. Plans and specifications are at the office of the Engineer, F. McArthur. Clerk, Geo. Beach.

The city council is about to construct about 14,000 lin. ft. of wooden sidewalks.

Sault Ste. Marie, Ont.
Tenders addressed to the Mayor will be received by the city clerk, C. J. Pim, until 5 p.m. May 26th, for the supplying and laying of 11,800 lin. ft. tile sewer pipe and appurtenances. Plans are at the office of the Engineer, W. W. VanEvery.

Stratford, Ont.
The ratepayers will vote on May 18th on a by-law providing for the expenditure of $10,000 on improvements to Agricultural Park.

St. Thomas, Ont.
Plans for the laying of 4,500 yards of concrete pavements are at office of the Engineer, M. Ferguson, who will receive tenders until 5 p.m. May 9th.

Sudbury, Ont.
Tenders will be received by the town clerk, W. J. Ross, until 6 p.m. May 18th, for laying approximately 35,000 sq. yds. pavements, on concrete basement, also for the construction of 5,000 lin. yds. concrete curbing. Offers will also be considered for vitrified block, bitulithic asphaltic concrete and asphaltic block. Specifications are at the Town Hall, Sudbury. Engineers, Chipman & Power, Mail Bldg., Toronto.

The town council has decided to expend the sum of $100,000 on street pavements, and to install a sewerage system at a cost of $50,000.

Sherbrooke, Que.
Tenders will be received by the city secretary for 500 ft. extra heavy galvanized iron pipe, threaded both ends, and fittings.

Toronto, Ont.
Tenders will be received by the Board of Control until May 12th, for the following pavements and sidewalks: asphalt on 5 streets, bitulithic on 1 street, concrete on 5 lanes, brick block on 1 lane, Rocmac macadam on 2 streets, concrete curbing on 6 streets, and concrete walks on 29 streets.

Tenders will be received by the Board of Control until May 12th for the construction of sewers on Terauley street and Neville Park Blvd.

The engineer's report presented to the York County Board of Highway Commissioners, proposes the following road improvements at the estimated cost [illegible]

[illegible] Kennedy Rd., 4½ miles, $20,000; Weston Rd., 4 miles, 11 ft. wide, granite [illegible] and macadam, $20,500; Markham village to station, ½ mile, concrete, $7,500; new road between Mimico and New Toronto, ½ mile, $7,000; new road through Weston Village, County Share, $12,500; Yonge St., at Thornhill, ½ mile, $4,000; Centre St., at Richmond Hill, $4,800; Vaughan Rd., 5 miles, $15,000; Woodbridge, ¾ mile, $2,000; Woodbridge, Weston Rd., with station, $5,000; Don Mills Rd., ¾ mile, $14,000; Malton Rd., 1½ miles, $7,500. The proposal is to have the approval of the Government Engineers. Engineer, E. A, James, 57 Adelaide E.

Toronto, Ont., Mimico

The village council proposes to construct a macadam roadway on Wellington Ave., for a distance of 1,200 ft.

Vancouver, B.C.

The Board of Works has recommended, at the given cost, the reconstruction of sewer in the lane south of Davie St., $27,00; Parker St., $4,600; McLean Dr., $6,200; Lane south of 8th, $6,060; Templeton Dr., $3,300; 10th, $3,200; 11th, $4,800; Victoria Dr., $4,600; 12th, $3,300; Arbutus, $1,300; S.S., B. C. Elec. trackage, $3,000; 15th, $3,800; Fir, $900. Engineer, F. L. Fellowes.

Walkerton, Ont.

The town council propose to purchase a road grader, and the necessary cement for walks and crossings.

Wallaceburg, Ont.

The construction of permanent roadways is being considered by the town council.

Waterloo, Ont.

The town council proposes to lay tarvia pavements with concrete foundation on Allan, Fisher, Park and William Sts., and bitulithic pavements on Albert St.

Welland, Ont.

Tenders will be received by the County Clerk, Robt. Cooper, until noon May 23, for the construction of 34 miles macadam road. Specification and plans at office of clerk and the Engineer in charge, Geo. Ross.

Woodstock, Ont.

The Oxford County Council has decided to spend the sum of $320,000 on a system of good roads. The work will spread over a period of 5 years.

CONTRACTS AWARDED

Belleville, Ont.

The City Council has awarded a contract to Foley & Gleeson, Ottawa, for paving Front and Bridge streets with asphaltic concrete, about 18,000 square yards at $2.38 per square yard.

Edmonton, Alta.

The following paving contracts have been awarded by the city council. Hodson, Littler & Goode, $25,859.22; Mauders & Gregory, $48,030; Swanson & McLean, $26,782.

Stratford, Ont.

The city council has awarded the contract for Erie St. sewer to W. G. Davies, 55 Caledonia.

Swift Current, Sask.

The contract for sewer and waterworks extensions has been secured by M. S. Holmes, 1st St., Souris, Man., and that for street grading has been awarded to Winn & Callaghan.

Saskatoon, Sask.

The following contracts have been awarded by the city council. Sewer and waterworks supplies, John East Foundry Co., 517 Rusholm Rd.; Western Foundry & Machine Co., Ave. E. and 23rd W.; Saskatchewan Iron Works, 127 22nd St. E. Sewer pipe and specials, McKenzie & Thayer, Ontario and 24th Sts., agents for American Sewer Pipe Co., Akron, Ohio, U.S.A.

Toronto, Ont.

The following contracts have been awarded by the Board of Control. For sewers, Routly & Sumners, Benlamond Ave., Cairns Ave., $2,398; Indian Rd. Cres., $1,123; W. E. Taylor, 438 Clinton St., Erie Terrace, $,3,297; Glendale St., $1,128; The Commr. of Works, Claude St., $310; Enda St., $1,550; Gerrard St., $2,110; Indian Rd., $2,569; Merrick St., $1.085; Patterson St., $760; The Midway Scheme, $18,800, and 5 lanes, $2,650. Street grading, Sherwood & Sherwood, 83 Browning Ave., Glenmount Park Rd., $4,658;; J. Franchischini, 1438 Dufferin St., Brookside Drive, $1,473; B. F. Law & Son, 143 Kingston Rd., 2nd Ave., 8th Ave., 4th St., Ladykirk. Asphalt pavements, Asphaltic Concrete Co., 74 King St. E., 2 lanes; the Commr. of Works, Violet St.. $2,012; Newsome St., $1,665; Strange St., $2,233; Sunnyside, $6,337, and Lipton St., $2,393.

Welland, Ont.

The town council has awarded to Somerville & Reid, the contract for laying 2 miles of sidewalks.

Winnipeg, Man., Transcona

The town council has awarded to the Cusson Lumber Co., St. Boniface, the contract for constructing 14 miles of plank sidewalks.

Railroads, Bridges and Wharves

Chatham Twp., Ont.

Tenders will be received by Commr. J. B. Clapp, Turnerville, until May 9th, for the construction of 2 steel and concrete bridges over Turrell Drain. Plans and specifications are at office of the Engineer in charge, W. G. McGeorge, C.E., 153 Queen St., Chatham.

Ellice & Logan Twps.. Ont.

Tenders will be received by the clerk, W. Davidson, Stratford, or the Engineer in charge, Jno. Roger, Mitchell, Ont., until May 9th for the construction of 50-ft. bridge of concrete and steel construction. Chairman, Com. W. Scott, Monkton, Ont. Warden, S. E. Smith, Listowel.

Frontenac, Ont.

The location of the Canadian Pacific Railway station at Lot 4, Con. 11, Twp. Hinchinbrook, mileage 36.74, has been approved.

New Glasgow, N.S.

Proposals and plans are invited by the town council until 5 p.m. May 15th, for the erection of a steel or concrete structure to replace the present steel trestle crossing at Potter's Brook. Further information can be had from the Town Clerk, Jas. Roy.

Ottawa, Ont.

The raising of part of the Wellington street viaduct is contemplated by the city council.

Province of Ontario

The Can. Pacific Rly. has been authorized to construct bridge No. 37.5 on Havelock Sub.-Div.

The Grand Trunk Railway Company has been authorized to construct bridges No. 336, mileage 179.99, 6th district; No. 334, mileage 175.86, 6th district, and No. 229, mileage 62.88, 5th district, Ontario Division.

Sturgeon Lake, Ont.

It is understood that the Verulam Twp. Council will pass a resolution to be forwarded to Ottawa asking that a wharf be built on Cons. 2 and 3, south of Sturgeon Lake.

Toronto, Ont.

Tenders will be received by the Board of Control until June 2nd, for the construction of a reinforced concrete 3-arch bridge over Bellwoods Park. Specifications, etc., at office of Railway & Bridge Section, City Hall.

Toronto, Ont., Willowdale

The York County Council are about to construct a 50-ft. concrete bridge. Engineer, Frank Barber, 57 Adelaide St. E., Toronto.

Toronto, Ont., Schomberg

The York County Council proposes to erect a new concrete 30-ft. span bridge over the creek north of Schomberg. Engineer, Frank Barber, 57 Adelaide E., Toronto.

Windsor, Ont.

The Detroit & Windsor Ferry Company has plans in hand for the construction of a concrete and steel construction dock and waiting room. Architects, Jno. Scott & Co., 1603 Ford Bldg., Detroit, Mich.

CONTRACTS AWARDED

Medicine Hat, Alta.

The Southern Alberta Land Co., Main St., has awarded the following firms contracts for excavating water ditches. Nohren & Mannit, Edmonton;; Crandell Bros., Carmangay, Alta.; H. Redmond, Edmonton.

Toronto, Ont.

The dredging contract has been awarded by the Toronto Harbor Commrs. to John E. Russell, 307 Logan Ave., at 13c per cubic yd.

Public Buildings, Churches, Schools, etc.

Berlin, Ont.

The erection of a post office is proposed by the Public Works Dept. Negotiations for a site are in progress.

Chatham, Ont.

Plans for a 4-room addition to Forest Street School have been drawn by J. L. Wilson & Son, architects, 64 Market Bldg. The building is to be completed by September. Estimated cost $20,000.

Compton, Que.

Tenders for the erection of the new town hall will be received by the Municipality of Compton until May 16th. Secretary, J. B. M. St. Laurent.

Edmonton, Alta.

Plans are being drawn for the addition

of a wing to the Royal Alexandra Hospital. Architect, A. Jeffers, Civic Offices.

Fort William, Ont.
The erection of a new Church on Brown and Mary streets is being considered by St. Agnes R. C. Church congregation.

Hamilton, Ont.
The question of the erection of a public library in the east end of the city will be voted on by the ratepayers before June 1st.

Innisfree, Alta.
Tenders will be received by the secretary-treasurer, L. M. Trace, until 8 p.m. May 15th, for the erection of a 2-room school building.

Midland, Ont.
Sub tenders marked as follows will be received by the secretary, C. D. Trueman, King St., until 6 p.m. May 11th, for the following trades connected with the erection of the new school. (1) masonry, carpentry, etc.; (2) 2 heating systems, either direct or indirect; (3) plumbing. Specifications are at the offices of the secretary and architects, Stewart & Witton, 7 Hughson S., Hamilton. General contractor, Alex. McDougall, Crompton and Yonge streets.

Medicine Hat, Alta.
Tenders will be received by the Sec.-Treas., James L. McCallum, until 5 p.m. June 1st, for the general contract for the erection of the Technical High School. Particulars can be obtained from the Architects, McCoy & Levine, Hooper and Huckvale Block.

Montreal, Que.
Certain additions to the Hospital, Dorchester St. E., are under consideration. Ed. & W. S. Maxwell, 6 Beaver Hall Sq., are the architects.

Montreal, Que., Verdun
The erection of a fire station on Osborne and Verdun Sts., is being considered by the town council.

Montreal, Que. (St. Henry)
Fred M. Hoadley, 58 Beaver Hall Hill, will receive tenders from May 6th to 16th for heating, ventilating, vacuum cleaning system and temperature regulation at St. Zotique Parish Church.

Mille Roches, Ont.
The time for receiving tenders for the school building for School Section No. 4 has been extended to May 11th. Sec.-treas., R. A. Murdock.

Murray Bay, Que.
Tenders for the erection of a post office will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until May 18th 1914. Plans are at the Dept., and the office of Armand Dupuis, Quebec City and P.O. Murray Bay. Specifications at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Ottawa, Ont.
Plans for a 2-room addition to Wellington Street School are being drawn by Architect, W. B. Garvock, Creighton Street School. Estimated cost $10,000.

Portage la Prairie, Man.
Tenders for the rection of a boarding school will be received by Duncan C. Scott, Dept. of Indian Affairs, Ottawa, until noon May 20th. Plans and specifications are at the Indian Office, Winnipeg, the Indian Agent Portage la Prairie and at the Department, Ottawa.

Petite de Grat, N.S.
Tenders for finishing the interior of the R. C. Church will be received by the parish priest, Rev. L. Chouinard, until May 10th. Plans and specifications are at the Glebe House.

Port Coquitlam, B.C.
Tenders are about to be called for the erection of the city hall. Parr, McKenzie & Day, 734 Granville St., Vancouver, are the architects. The estimated cost is $20,000.

Port Lambton, Ont.
A site on Front St., has been purchased for the erection of a customs house and emigrant office.

Raleigh Twp., Ont.
Plans for the erection of a one-storey school are being drawn by Adams & Adams, architects, 49½ King St. W., Chatham, who will receive tenders from May 15th to 30th.

Regina, Sask.
A by-law has been carried providing for the sum of $36,000, for the purchase of a site for a new collegiate building, and enlarging and equipping the present one.

A by-law has been passed by the city council providing for extensions to the fair building and grounds, at an estimated cost of $12,000.

Richmond, Que.
Plans are being drawn by H. G. James, architect, Whiting Blk., Sherbrooke, for the addition of a tower to the Anglican church.

Sprucedale, Ont.
Tenders will be received by W. J. Fowler until May 15, for the erection of a 2-roomed frame-brick veneered or cement school house on concrete basement, in the Parry Sound district. Separate tenders for basement and building, according to the Government plans Nos. 6 to 21 for Rural schools.

Sandwich, Ont.
The erection of a school building, at a cost of $65,000, is being considered by the Public School Board.

Souris, P. E. I.
Tenders will be received by the Director of Contracts, Department of Militia & Defence, Ottawa, until noon, May 12, for the construction of a 2-target rifle range. Plans are at offices of the officer commanding the 6th Division, Halifax, N.S., the town clerk, Souris, and the Director General of Engineer Services, Headquarters, Ottawa.

Stratford, Ont.
By-law providing for the construction of an incinerator at a cost of $11,500 will be submitted to the ratepayers on May 18th.

Toronto, Ont.
A new site at the corner of Danforth Ave. and Moscow Ave., has been purchased by the Roman Catholic Church of the Holy Name. Architect, A. W. Holmes, 10 Bloor St. E.

The Presbyterian Foreign Mission Society intends to build a home in the Rivercourt Dist., for missionaries on furlough.

Toronto, Ont., Mimico
Plans for the erection of the public library being prepared by S. B. Coon & Son, architects, Ryrie Bldg.

Toronto, Ont., Weston
A site has been purchased on Main St. for the erection of a hall for Humber Lodge, A. F. & A. M.

Victoria, B.C.
Tenders are about to be called for the erection of the new St. Barnabas English Church on Cook and Caledonia Sts. Mr. J. Drummond Beatson, of Jones & Beatson, Hutchinson Bldg., Vancouver, is the architect.

CONTRACTS AWARDED

Berlin, Ont.
The contract for the 5-room addition to Victoria St. School has been awarded by the Board of Education to C. Braun & H. Dunker, 149 King S. W., $16,010.

Brantford, Ont.
The Rawdon St. School contract has been awarded by the Board of Education to P. H. Secord & Sons, Ltd., 133 Nelson St., Brantford. The contract includes all trades but heating, plumbing and ventilating, which are not yet let.

Chilliwack, B.C.
The town hall contract has been awarded by the municipal council to Shirley & Love, Chilliwack.

Wawanosh East Twp., Ont.
The school contract has been secured by Wm. J. Deyell, Wingham, P.O.

Fredericton, N.B.
The contract for the new graded school at Fredericton has been awarded to the contracting firm of R. A. Corbett, of St. John. The contract price was in the vicinity of $40,000, and the building is to be ready for occupancy in the early fall.

Hardisty, Alta.
The school contract has been secured by Bennett & Dehman.

London, Ont.
The contract for the erection of a chapel and for additions to the hospital has been awarded to Jno. Putherbough, 1006 Wellington St. Architects, Watt & Blackwell, Bank of Toronto Chmbrs.

Mitchell, Ont.
The following contracts have been awarded in connection with the erection of the new school building. Masonry and carpentry, Wm. Eizerman, Toronto St.; iron work, A. Hill & Co., Main St.; plumbing and heating, Geo. Sills, Main St., Stratford; painting, Mr. Swan, c/o Sec. of Board.

Montreal, Que.
The following sub contracts have been awarded in connection with the alterations to Esplanade Ave. School. Carpentry, Wm. Rutherford & Sons, 425 Atwater Ave.; architectural iron, Dom. Arch Iron Works, 63 Dalhousie. The contract for tile and marble work is to be let shortly.

Montreal West, Que.
The following contracts have been awarded in connection with the erection of Westminster Ave. fire and police sta-

hall. General contractor, Ed. Garrigan, [illegible] Ave.; heating and plumbing, Thos. L. Bain, 31 Westminster Ave.

North Dorchester Twp., Ont.

The Putnam School contract has been secured by Geo. Craik, Crampton, Ont.

Ottawa, Ont.

R. E. McKinstry & Son, 91 2nd ave., have secured the contract for the Billings Bridge Presbyterian Church on Sunnyside Ave.

Point Grey, B.C.

The Shaughnessy Dist. School contract has been awarded to Coffin & McLennan, 1701 Broadway W., Vancouver; heating and wiring is not in the contract.

Regina, Sask.

The contract for extensions to Regina College, 16th Ave., has been awarded to R. J. Lecky Co., Ltd., 304 Northern Crown Bank Bldg.

Smiths Falls, Ont.

The contract for addition to the post office, customs and armoury has been secured by G. T. Martin, Daniel street.

Vancouver, B.C.

The following contracts have been awarded in connection with the erection of Clinton St. School. B. C. Granitoid & Contracting Co., Ltd., 142 Hastings St. W., $58,275; heating and ventilating, General Fire Extinguisher Co., 1140 Hastings St., $10,000.

Winnipeg, Man.

The contract for additions to Broadway Baptist Church has been secured by Claydon Bros., Furby Place.

Business Buildings and Industrial Plants

Burrard Inlet, B.C.

The Vancouver Lumber Co., Ltd., propose to erect at Roche Point a 12-machine mill. The renovation of the existing cedar lumber mill will be proceeded with and a wharf built.

Calgary, Alta.

Tenders for the erection of a storage elevator will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until noon June 1st. Grain cleaning machinery will be installed. Plans and specifications are at office of the Chief Engineer of Grain Commissioners, Saskatoon.

Chatham, Ont.

The erection of stores and apartments is being considered by Fred Bates, 24 William St. S.

Dauntless, Alta.

The erection of a factory for the supply and repair of threshing machines is being considered by the Dominion Harvester Co.

Forest, Ont.

The erection of a warehouse, at a cost of $7,000, is proposed by J. N. Mills, Main St.

Galt, Ont.

Certain alterations to the Galt Curling Club are being considered.

Tenders for the erection of a $30,000 factory, for the Maple Leaf Bedding Co., will be received by the managing director, Roy Torrance, S. Water St.

Glace Bay, N.S.

Plans for the erection of a theatre and stores are being drawn by W. C. Barnes, architect, Wyse Bldg., Moncton. Tenders will be called shortly.

Montreal, Que.

A permit for the erection of store and flats, on Ontario St., at a cost of $6,000, has been granted to Leonce April, 1421 Ontario St. E.

Montreal, Que., Verdun

Mr. Dunning, 43 St. Sacrement St., is taking prices on roofing, heating, plumbing and electric in connection with the erection of a $10,000 picture theatre on Church street.

Ottawa, Ont.

The erection of a warehouse on York street is being considered by Jos. Grant, 17 York street.

Port Arthur, Ont.

The erection of a frog and switch factory is proposed by Conley Frog & Switch Works, Memphis, Tenn. The ratepayers have granted the company a bonus of $25,000, and the work will start as soon as possible.

Prince Rupert, B.C.

A. J. Prudhomme, proprietor of the Savoy Hotel, has purchased a site on 5th St. and Borden Ave., for the erection of a hotel.

Rock Island, Que.

The erection of a machine shop is contemplated by the Union Twist & Drill Company.

Saskatoon, Sask.

It is understood that Speers & Mighton will erect a produce warehouse on 1st Ave. and 23rd St., at a cost of $27,000.

Swift Current, Sask.

I. A. Welk & J. J. Nickel, Rosthern, Sask., are having plans drawn for the erection of a flour mill with a capacity of 1,000 bbls. daily.

Toronto, Ont.

The Star Printing & Publishing Co. propose to make additions to their garage on Dalhousie St.

Thos. McCauley, 45 Bowden Ave., has purchased a site on Danforth and Jones, and proposes to erect a $40,000 store and apartment block thereon.

A site with 60 ft. frontage on College St., east of Bathurst St., has been purchased by the Royal Bank of Canada.

Plans for a factory on Van Horne St., have been drawn for the Canada Last Company.

Tenders for the erection of a 5-storey office building, on Queen St. W., are invited by the Architect, Alf. Baker, 15 Gerrard St. E.

H. R. Reynolds, 213 Pearson Ave., has purchased 132 ft. frontage on Roncesvalles and Wright Avenues, upon which he proposes to erect 7 stores and apartments.

Plans have been drawn for additions to the Dominion Brewery Company's premises, 496 Queen E. Tenders are not yet called.

W. J. Mitchell, of 718 Broadview Ave., proposes to erect a drug store and apartments, on Danforth Ave., at a cost of $6,000. Architect, P. H. Finney, 79 Adelaide E.

Vancouver, B.C.

Plans are being prepared for the erection of a $150,000 theatre, on Harris St. and Gore Ave. Emil Guenther, North West Trust Bldg., is the architect.

A permit for warehouse repairs at 860 Cambie St., have been granted to the Mainland Trust Co. Geo. Snider & Brethour are the architects and general contractors.

Windsor, Ont.

F. H. Laing intends to make alterations to his store on Ouellette street. John Scott & Co., 1603 Ford Building, Detroit, Mich, are the architects.

Plans are being drawn for additions to the Windsor Jockey Club grand stand. Estimated cost $15,000. Architects, Smith, Hinchman & Grylls, Washington Arcade Building, Detroit, Mich.

Winnipeg, Man.

Tenders for a 4-storey addition to the warehouse of Burroughs, Stewart & Milne Co., Jarvis St. E., are invited by the architect, D. W. Bellhouse, Canada Bldg.

A. H. S. Murray, 300 Garry Bldg., has under consideration the erection of stores on Sherbrook and Wolseley Sts.

CONTRACTS AWARDED

Didsbury, Alta.

The hotel has been secured by A. A. Rose, 204 David Block. J. E. Burrill, 601 Centre St., are the architects.

London, Ont.

The contract for addition to the store and office building, Dundas St., owned by W. G. Young, has been awarded to Messrs. Willis, Talbot & Oxford Sts., and J. Putherbough, 1006 Wellington St.

Medicine Hat, Alta.

The contract for the Tabor Candy Co.'s factory has been awarded to H. B. Curtis, 235 Braemar St., $15,000.

Montreal, Que.

The contract for the erection of a factory for Fyon & Fyon, 288 Garnier St., has been secured by P. Corbeil, 382 Fabre street.

A contract for the erection of a store on Lagauchetiere St. W., has been let by Thos. M. Morgan to S. Gillettz, 1206 St. Antoine St.

The sub contract for heating and plumbing on the alterations to the stores of Keuffel & Esser, 252 Notre Dame W., has been let to McKnight & Blackader, 91 Inspector St.

Mt. Brydges, Ont.

The Union Bank contract has been secured by C. Insell, Waterloo & Huron Sts., London.

Ottawa, Ont.

The contract for the erection of store and apartment on Bank and Lisgar Sts. has been let to Chas. Hopewell, Clemow street.

The contract for the erection of a warehouse on Bay street for E. W. Marshall, has been let to A. G. Marshall, 217 Booth street.

Port Arthur, Ont.

The contract for Mr. F. E. Gibb's garage, on Court St., has been let to Geo. Otto, 206 Arthur St. Accommodation will be provided for 100 cars.

St. Andrews, N.B.
The C. P. R. hotel contract has been secured by Robert Clark, of St. Andrews.

Toronto, Ont.
The contract for the erection of the Roncesvalles and Howard Park Ave. branch of the Dominion Bank, has been awarded to Jackson Lewis Co., Bell Telephone Building.

The contract for the Imperial Bank and office building, on Queen and Yonge Sts., has been secured by Harris & Harris, Confed. Life Bldg.

The contract for interior alterations to the stores of F. E. Dalton, 99-101 Yonge St., has been let to W. T. Joy, 86 High Park Ave.

White Rock, B.C.
The contract for the erection of the White Rock Resort Development Company's hotel has been secured by Miller & Jewhurst, Westminster Trust Block, New Westminster.

Windsor, Ont.
The following contracts have been awarded on the store and office building on Pitt street east: carpentry, steel and roofing, Peter Osterhout; masonry, Robt. Parker; 258 Ouellette Ave.; plastering, Frank Phillips, 43 Elliott street; heating and plumbing, Windsor Hardware Company.

The contract for the alterations at the Heintzman Piano Co.'s store has been let to the Williamston Const. Company of Windsor.

Residences

Dartmouth, N.S.
Harris & Horton, architects, Keith Bldg., 41½ Barrington St., Halifax, are about to prepare plans for residences for Mr. Harold Austen, Pleasant St., and Mr. Walter Bishop, Portland St.

Edmonton, Alta.
A permit for the erection of apartments on Victoria Ave., at a cost of $50,000 has been granted by D. C. Robinson, c/o General Contractor.

Plans for the erection of a $50,000 apartment block for O. Robbins, 855 24th St., have been filed with the building inspector.

Grimsby, Ont.
Joseph Daw, architect, of St. Catharines, is drawing plans for A. Burling for the erection of a bungalow. Estimated cost $5,000.

Halifax, N.S.
Plans are being prepared by Harris & Horton, architects, Keith Bldg., 41½ Barrington Sts., for residences for A. O. Sanderson, 14 Lucknow St., and Dr Zwicker, 25 Barrington St.

Hamilton, Ont.
Plans for the erection of 3 residences on Beulah Ave., for Seymour & Walker, have been drawn by Geo. J. [illegible], architects, Bank of Hamilton.

London, Ont.
The erection of a 3-storey apartment house is contemplated by H. A. Kuhl, 551 Princess Ave.

Medicine Hat, Alta.
The erection of a $30,000 apartment house is proposed by Architect and general contractors, Harrison & Ponton, Hooper and Huckvale Block.

Montreal, Que.
The following permits for the erection of residential buildings at an estimated cost as specified, have been recently granted. Jos. St. Pierre, 14 flats, Chomedy St., $50,000; R. H. Crombie, 2 residences, Vendome St., $10,000; M. Magnan, flats, St. Denis St., $10,000; H. Drapeau, flats, Visitation St., $7,500; J. B. Sinay, flats, Boubouniere St., $6,000; H. Demers, flats, De La Roche St., $5,000; G. Piche, flats, Montgomery St., $5,000; P. Secourst, flats, Lecaron St., $5,775; A. Heter, flats, Daniel St., $6,000; A. Frenette, flats, Delanaudiere St., $5,500; D. Letourneau, flats, Chambly St., $5,000; A. Sansfacon, flats, St. Jerome St., $5,500; F. Lamaire, flats, Hall St., $6,000; L. Letourneau, flats, Cartier St., $20,000; Chadburn & Hunt, residence, Vendome Ave., $8,000; Chatel & Laurin, flats, Northcliff St., $8,000; J. V. Belanger, flats, De La Roche St., $20,000; W. F. Drysdale, 2 residences, Addington Ave., $12,000; W. Kinnon, flats, Henri Julien St., $6,000; D. Legault, flats, Delorimier St., $7,500; D. Asselin, flats, Chambly St., $9,000; Lavoie Lavoie, flats, Messier St., $5,800; O. Michaud, flats, Marquette St., $8,000; A. Piche, flats, Beaubien St., $35,000; J. Batte, flats, Pie IX. Blvd., $5,000.

Montreal, Que., Cote de Neiges
A permit for the erection of flats on Lacombe St., to cost $7,000, has been granted to Ont. Paquette, 905 Maplewood Ave.

Montreal, Que., Notre Dame de Grace
A permit for the erection of a residence, to cost $5,500, has been granted to Pascal Lemieux, Cote St. Luke.

Montreal, Que., Outremont
General contractor, W. Clermont, 300 St. Denis St., is taking prices on all sub trades connected with the erection of 6 flats on Bloomfield St.

Plans for 2 cottages on Villeneuve St., for H. Hanson, have been drawn by R. Gariepy, architect, 25 St. James, Montreal; estimated cost $16,500.

Montreal, Que. (Westmount)
Tenders are in for 4 residences on Bruce Ave. for S. Berlin, 462 Elm Ave., Westmount. The contract will be awarded shortly. Architect, C. Duport, 192 St. Catherine W.

Niagara Falls, Ont.
Tenders on the erection of a $6,000 residence for Kenneth Anderson, Park St., are invited by the architect, C. M. Borter, Niagara Falls South.

Ottawa, Ont.
Tenders on a $7,000 residence on Daly St., for Chas. A. McCool, 445 Wilbrod, are invited by the architect, W. E. Noffke, Central Chmbrs.

Frank P. Cosgrove proposes to make certain additions and alterations to his apartments on Nelson St. at a cost of $5,500.

G. A. Clark, 106 Kent St., proposes to erect a $7,500 apartment house on MacLaren street.

Point Grey, B.C.
A permit for the erection of a $12,000 residence, on 49th Ave. and Granville St., has been issued to G. McSpadden, 1416 Cotton Drive. Architect, H. B. Watson, Holden Bldg., Vancouver.

Sherbrooke, Que.
Plans for a tenement on Larocque St., have been drawn for Felix Naiseau, 35 St. Louis St.

East Sherbrooke, Que.
Plans for a residence to cost $7,000, on Woodward Ave., for Wm. Wright, are being drawn by H. G. James, architect, Whiting Block.

Saskatoon, Sask.
A site has been secured on 4th Ave. for the erection of a $150,00 apartment block by Anthony Le Jeune, 13 Clinkskill Bldg., plans have been drawn; and work is to start this summer.

Toronto, Ont.
Whitty & Kehler, 190 Jones Ave., are open for tenders on plumbing, plastering and lathing, wiring, hot air heating, roofing and mantels in connection with the erection of two residences.

Plans for the erection of apartments on the east and west side of University Ave., are being drawn by J. H. Haffa, 209 Peterkin Bldg.

J. H. Mills, 379 Danforth Ave., invites tenders on all trades in connection with the erection of three stores and apartments.

Tenders for the erection of a duplex residence, on 186 Sorauren, for C. H. Goold, are invited by the architect, Joseph Q. Green, 796 Broadview Ave.

Vancouver, B.C.
A permit for the erection of apartments on 2833 Oak St., at a cost of $15,000, has been granted to Jas. Adamson, 2241 Granville St.

Windsor, Ont.
C. H. Crane and J. C. Pennington, architects, LaBelle Bldg., have plans in hand for a $15,000 residence on Victoria St. for Mr. W. R. Bond.

Winnipeg, Man.
Permits have recently been issued to the following for the erection of residential buildings at the specified estimated cost. Simmons Bros., apartment block, William Ave., $30,000; J. A. Martin, residence, McMillan Ave., $6,000; S. Lobel, apartment block, Wolseley and Lipton St., $100,000; Chisholm & Sheps, apartment block, Aikens St., $65,000; West End Realty Co., 2 residences, Yale Ave., $32,000; residence, Lipton St., $6,500; 6 residences, Dorchester Ave., $27,000; residence, Lenore St., $6,500; 4 residences, Dorchester Ave., $18,000; 3 residences, Dorchester Ave., $19,500; 2 residences, Dominion St., $13,000; W. W. Fleming, 2 residences, Dominion St., $12,000; Sparrow Bros., residence, Oxford St., $12,000.

CONTRACTS AWARDED

Montreal, Que.
A contract for the erection of a store on Chambly St., has been awarded by Ant. Chartand, 343 Amherst St., to M. Bourdon & Fils, [illegible] St.

(Continued on page 78)

Tenders and For Sale Department

Tenders for Cement Walks

CITY OF SAULT STE. MARIE
Ontario

Sealed tenders, fully endorsed and marked "Tenders for Cement Walks," addressed to T. E. [illegible] Mayor, Sault Ste Marie, Ont., will be received by the City Clerk up to five o'clock [illegible] Thursday, **May 28th, 1914**, for the construction of about 84,000 square feet of cement concrete sidewalks.

Specifications and plans may be seen and all information and forms of tender obtained at the office of the City Engineer, Sault Ste. Marie, Ontario.

A marked cheque for $1,200 payable to the order of the City Treasurer, must accompany each tender. A bond to the amount of $4,000 or in lieu thereof, a cash deposit of $2,500, will be required of the successful bidder.

The lowest or any tender not necessarily accepted.

18-19 C. J. PIM, City Clerk.

TOWN OF SUDBURY
Province of Ontario

Pavements and Curbing

Sealed tenders will be received by the Town Clerk until 6 p.m., **Monday, May 18th, 1914**, for the laying of approximately 35,000 square yards of pavements, on concrete base. Also for the construction of 5,000 lineal yards of concrete curbing.

Offers will be considered for vitrified block, bitulithic, asphaltic concrete and asphaltic block.

Specifications, plans, profiles, etc., may be seen at the Town Hall, Sudbury, after May 9th. Additional information may be obtained at the Engineers' Office, Mail Building, Toronto.

L. O. O'CONNOR, Esq., Mayor.
W. J. ROSS, Esq., Town Clerk.
CHIPMAN & POWER, Engineers. 18

The Town of Carleton Place
Ontario

Sealed tenders addressed to the Clerk, will be received by the Commission of the Town of Carleton Place, until 6 p.m. of the **18th day of May, 1914**, for the following works:

Contract No. 2.—Furnishing materials for and constructing a Pump House and Intake Pipe.

Contract No. 3.—Furnishing materials for and constructing a Sewage Disposal Works.

Plans, specifications and forms of tender may be seen at the offices of Messrs. Aird Murray & Lowes, Consulting Engineers, 186 King St. W., Toronto, or at the office of the Town Engineer, Carleton Place, Ontario.

The lowest or any tender not necessarily [illegible]

A. R. G. PEDEN,
Clerk of Commission.
WM. BAIRD,
Chairman of Commission.
MESSRS. AIRD MURRAY & LOWES,
Engineers,
18 186 King St. West, Toronto.

Concrete Pavement

Tenders for approximately 4,500 yards of Concrete Pavement, will be received by the undersigned up to 5 o'clock p.m., **Saturday, May 9th.** Plans and specifications may be had at the City Engineer's Office.

M. FERGUSON,
City Engineer.
St. Thomas, April 24, 1914.
17-18

Tenders for School

Sealed tenders will be received by the undersigned up to **May 27, 1914**, for the erection of an 8-roomed school building in the village of Paisley.

Plans and specifications may be seen at the office of Jas. L. Russell, architect, Stratford, The Contract Record & Engineering Review, 220 King Street West, Toronto, or at the office of the undersigned at Paisley.

Lowest or any tender not necessarily accepted.

W. R. BARNETT,
Secretary of the School Board,
18-20 Paisley, Ont.

CITY OF REGINA

Tenders for Trenching and Laying Water Mains

Sealed tenders, marked "Laying of Water Mains," will be received by the City Commissioners, Regina, Sask., up till noon, **May 25th, 1914**, for the trenching and laying of Water Mains on certain streets in the City of Regina. Specifications and other information may be received at the office of the undersigned.

A marked cheque covering five (5 p.c.) per cent. of the tendered amount must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

J. M. MACKAY,
18-20 Superintendent of Waterworks.

Notice to Contractors

Sidewalks

Sealed tenders will be received, addressed to the Chairman of the Board of Works, City Buildings, St. Catharines, Ont., up to noon, **Thursday, May 14th, 1914**, for the construction of approximately 21,000 lineal feet of four-foot concrete sidewalk, and approximately 20,000 lineal feet of four-foot concrete sidewalk and combined six-inch concrete curbs.

Plans and specifications and a list of the streets may be seen at and forms of tender obtained from the office of the City Engineer. Envelopes containing tenders must be marked as to contents. All tenders must be accompanied by a marked cheque for 5 per cent. of the amount of the tender, together with the names of two personal sureties or the bond of a Guarantee Company approved by the City Treasurer. The lowest or any tender not necessarily accepted.

W. P. NEAR,
18 City Engineer.

Tenders for Electric Passenger Elevator

Tenders, addressed to the undersigned, will be received by registered post only up to noon on **Tuesday, May 12th, 1914**, for the complete supply and installation of electric passenger elevator on east side of City Hall, Toronto.

Copy of applications may be seen and tender **form obtained**, together with all information Department, City Hall, Toronto. Conditions perrelative thereto, at the offices of the Property taining to tendering, as prescribed by city by-law, must be complied with, and envelopes containing tenders must be plainly marked on outside as to contents. A bond from a Guarantee Company, satisfactory to the Corporation, will be accepted in lieu of the personal sureties provided for in the tender form.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
April 30th, 1914. 18

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, May 15th, 1914
for

Enlargement Davisville School
All trades

Enlargement Western Avenue School
Heating and Ventilating Heat Regulating
Plumbing Electric Wiring

Lansdowne School
Skylights Prism Floor Lights
Felt and Gravel Roof

Duke Street School
Plumbing

Kent School
Plumbing

Pauline Avenue School
Ash Hoist

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

All tenders must be on revised forms.

W. C. WILKINSON,
Secretary-Treasurer.
J. W. JACKSON,
18 Chairman of Committee.

TOWN OF THOROLD
Province of Ontario

Tenders for Pavements

Marked tenders for pavements, addressed to the Town Clerk, will be received until 8 p.m., **Wednesday, May 15th, 1914**, for the construction of 6,600 square yards of pavement on Pine and Mill Streets in the Town of Thorold.

Plans and specifications may be seen at the office of the Engineers, Mail Building, Toronto, and at the Town Hall, Thorold.

Marked cheque for $1,500 required.

The lowest or any tender not necessarily accepted.

JOS. BATTLE, Esq., Mayor.
D. J. C. MUNRO, Esq.,
Town Clerk,
CHIPMAN & POWER, Engineers
18

Tenders for Sewerage Works

City of Sault Ste Marie, Ont.

Sealed tenders, fully endorsed, and marked "Tender for Sewerage Works," addressed to T. E. Simpson, Mayor, Sault Ste. Marie, Ont., will be received by the City Clerk, up to five o'clock p.m., on **Tuesday, May 26th, 1914**, for supplying and laying about 11,800 lineal feet of tile sewer pipe, with appurtenances.

Specifications and plans may be seen and all information and forms of tender obtained at the Office of the City Engineer, Sault Ste. Marie, Ont.

A marked cheque for 5 per cent. of the amount of the tender, payable to the order of the City Treasurer, must accompany each tender.

The lowest or any tender not necessarily accepted.

17-18 C. J. PIM, City Clerk.

MEDICINE HAT, ALBERTA

Tenders for the General Contract of the New Technical High School

Sealed tenders addressed to James L. MacCallum, Secretary of the Medicine Hat School Board, and endorsed "Tenders for the General Contract of the Technical High School," will be received up to 5 o'clock p.m., **June 1st, 1914**. Full particulars may be had at the office of McCoy & Levine Engineering Company, [illegible]vale Bldg., Medicine Hat.

An accepted cheque made payable to McCoy & Levine for the sum of ten dollars ($10.00) will be required from each contractor taking out plans and specifications on this work as a guarantee that they will put in a bona fide tender and return plans and specifications.

Each tender must be accompanied by an accepted cheque payable at par Medicine Hat, to the Medicine Hat School Board to the amount of five (5) per cent. of the tender.

Should the contract be awarded, the successful bidder shall be required to execute a guarantee bond on an approved surety company to the amount of twenty (20) per cent. of his tender as a guarantee for the faithful fulfillment of his contract.

The Cheques of the unsuccessful bidders will be returned within six days after the contract is awarded.

The right is reserved to reject any or all bids or to waive any defects.

The lowest or any other proposals not necessarily accepted.

McCoy & Levine Engineering Co.

Dated at Medicine Hat,
This 24th day of April, 1914. 17 18 19

CITY OF BERLIN

Tenders for Pavement

Sealed tenders, addressed to A. H. Millar, City Clerk, will be received up to 5 p.m., **May 14th, 1914**, for approximately 17,000 sq. yds. of bitulithic or sheet asphalt and 2,800 sq. yds. of brick pavement in the city of Berlin. Plans and specifications may be seen at the office of the Contract Record and Canadian Engineer, Toronto, and at the office of the City Engineer. The lowest or any tender will not necessarily be accepted.

HERBERT JOHNSTON,
18 City Engineer

Welland County Road System

Tenders for Macadam Road

Tenders will be received by the undersigned up to 12 o'clock noon, **May 23rd, 1914**, for the construction of 34 miles of Macadam Road on the Welland County Road System.

Specifications and forms of tender may be seen at my office and also at the office of George Ross, C.E., County Engineer, Welland, Ont.

Tenders for the whole 34 miles or any section thereof will be accepted.

The lowest or any tenders not necessarily accepted.

ROBERT COOPER,
18-19 County Clerk.

Notice to Contractors

Sealed tenders will be received by the undersigned up to **May 11th, 1914**, at 6 p.m., on a new eight room school to be erected in Midland. Tenders to be marked as follows:—

(1) Tender for Masonry, Carpenter Work, etc.

(2) Tender for two heating systems, either direct or indirect.

(3) Tender for Plumbing.

Each tender to be accompanied by a cheque for **10** per cent. of same.

Lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the office of the Secretary at Midland or at the office of the Architects, Messrs. Stewart & Witton, Hamilton.

C. D. TRUEMAN, Secretary.
Midland, Ontario.
Midland, April [illegible] 1914 18

City of Regina

Pavements

Sealed tenders, marked "Tender for Pavements," and addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, June 1st, 1914, for the construction of 11,000 square yards of pavement.

A copy of specifications will be furnished to intending bidders upon receipt of a marked cheque for $25.00 made payable to the City of Regina, said cheque will be returned to bidder on the receipt of a bona fide tender and the return of specifications.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The city reserves the right to divide the works into two or more contracts and to reject any or all tenders.

17-19 F. McARTHUR, City Engineer.

City of Regina

Sewers

Sealed tenders, marked "Tender for Sewers," and addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, **May 25th, 1914**, for the construction of storm and domestic sewers.

A copy of specifications will be furnished to intending bidders upon receipt of a marked cheque for $25.00 made payable to the City of Regina, said cheque will be returned to bidder on the receipt of a bona fide tender and the return of specifications.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The City reserves the right to divide the works into two or more contracts and to reject any or all tenders.

17-19 F. McARTHUR, City Engineer.

School Board

Section 27, York Township

Tenders Wanted

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received until the **18th of May, 1914**, for the several trades required in the erection of new twelve-roomed school building on Torrens Ave., Todmorden.

Specifications may be seen and all information obtained at the office of the architects, Messrs. Lindsay, Brydon & Greig, corner Trinity Square and Yonge Street, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or the equivalent in cash. Tenders must be in the hands of the secretary and treasurer, No. 1 Logan Avenue, North Todmorden, not later than 6 p.m. on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

(Signed) **G. T. DAVIS, Chairman.**
WM. BURGESS, Sec.-Treas.
J. A. McDONALD.
18 Trustees

Tenders for Concrete Bridge Construction

City of St. Catharines, Ontario

Sealed tenders for the completion of the Ontario Street High Level Bridge, addressed to the City Clerk, will be received until five o'clock [illegible] 26th day of May 1914

Principal Items of Work

Excavation, 600 cu. yds.
Concrete Masonry without reinforcement, 2,047 cu. yds.
Reinforced concrete masonry, 1,725 cu. yds.
Steel reinforcement, 161,000 lbs.
Iron fence, 1,620 lin. ft.

Information for tenderers, plans and specifications may be obtained at the office of the City Engineer, St. Catharines, Ont.

A certified cheque in the amount of $3,000, payable to the City Treasurer, is required to be deposited with the bid, and a construction bond for [illegible] must be furnished the city by the tenderer to whom the contract is awarded.

The city reserves the right to reject any or all tenders or to accept the tender which would best serve the interest of the city.

W. [illegible],
18 City Engineer.

Hydro-Electric Power Commission of Ontario

Sealed tenders will be received up to 4 p.m., **Monday, May 18th, 1914**, for the construction of dams, head-works, etc., and for the excavation of a canal in connection with a power development at Eugenia Falls.

Plans and specifications may be seen and forms of tender obtained at the offices of the Commission on and after Monday, May 4th, 1914.

Parties receiving plans and specifications will be required to deposit a marked cheque for $5.00 with the Secretary of the Commission pending the return of the same in good order, either with or without a tender.

By order.

W. W. POPE, Secretary.

Hydro-Electric Power Commission,
Continental Life Building,
Toronto, Ont.

Parties inserting this advertisement without written authority will not be paid for same. 17-18

Agents Wanted

Large British firm manufacturing water level indicators and other municipal engineering equipment, wants representatives in Eastern Canada, Middle West and Far West. Apply Box 10, Contract Record & Engineering Review, Toronto. 16-19

Positions Vacant

WANTED—Architectural Draughtsman capable of detailing and looking after work from beginning to end. State experience and salary required. Permanent position. Box 17, Contract Record, Toronto. 18

Positions Wanted

To Architects.—Superintendent of works is open for re-engagement. Familiar with all kinds of office buildings, schools, banks and hospitals. Ready to take charge of works at once. Reply "Superintendent," Contract Record, Toronto. 17-18

First Class Steel Inspector wants re-engagement by June 1st as inspector or foreman of structural steel. Advertiser, 21 Sullivan Street, Toronto. 17-19

Young civil engineer, familiar with transit, level, steel and concrete design, sewers, foundations, concrete piles, desires good position with architect or contractor. Box 19, Contract Record, Toronto. 18-19

Residences

(Continued from page 79)

Montreal, Que., Ville la Salle

The contract for the erection of H. Bergevin's cottage has been secured by Dube & Co., Lachine, Que.

Ottawa, Ont.

The contract for the erection of an apartment block on Clarence street for the International Securities Corporation has been secured by L. F. Tradburks, 103 Booth Bldg., Sparks street.

The contract for the erection of a residence on Linden Terrace, has been let to Hopper Bros., 15 Linden Terrace.

Sydney, N.S.

The contract for the erection of a residence for Dr. W. H. Rice, 322 Charlotte St., has been let to A. E. Cunningham.

Toronto, Ont.

The following additional contracts have been awarded on the apartments being erected on College St., near Shaw St., by J. H. Haffa, 209 Peterkin Bldg. Heating, W. Schulkins, 932 College St.; plumbing, H. Salamansky, 143 St. Patrick St.; ornamental iron, Beaver Brass & Orn. Iron Works, 24 Adelaide St. W.; carpentry, K. Norafsky, 261 Richmond W.

The contract for the erection of a residence on Lawrence Park, for S. E. Hessin, Parkview Mansions, has been let to Beigo Canadian Constr. Co., Kent Bldg.

Victoria, B.C.

A contract for the erection of a residence, on Rockland Ave., for A. P. Luxton, K.C., has been let to Geo. Calder, 82 San Juan.

Windsor, Ont.

The following contracts have been awarded in connection with the erection of a 2-family residence on Hall Ave., for Frank Fenton. Masonry, John Ferguson; carpentry and roofing, Elmer Gignac; plastering, E. Kennedy & Son; painting, J. Lauckner; heating and plumbing, R. Paddon & Son; electrical, Gas & Electric Company.

Power Plants, Electricity and Telephones

Edmonton, Alta.

The United Collieries of Canada has offered to supply the city with power, cheaper than city can produce it. If the offer is accepted a complete new plant will be required.

Embro, Ont.

The hydro power by-law having been carried the installation will be completed in about 3 months.

Ottawa, Ont.

Plans for extensions to the electric station, Laurier St. E., have been drawn by J. E. Brown, Supt. Elec. Dept.

Prince Albert, Sask.

At a meeting of the council it was decided to invite Mr. McRae, who represents a syndicate which is asking a 20-year franchise, to come West to enter into negotiations with the city, with reference to the proposed street railway system.

Shoal Lake, Man.

Tenders will be received by the Sec.-Treas., F. Dobbs, until 18 o'clock May 28th, for furnishing and installing a semi-Diesel Oil engine, furnishing and installing d.c. generator booster and switchboard, furnishing and installing storage battery. Construction of concrete and frame power house building, supply of poles, line supplies, copper wire, d.c. meters and tungsten street lighting equipment. Erection of pole line. Plans at offices of the Consulting Engineer, John Galt Engineering Co., Winnipeg and Calgary, and at the Town Hall, Shoal Lake.

Sudbury, Ont.

The Sudbury & Copper Cliff Rly. Co., propose that lines to be laid in conjunction with the new paving scheme.

Toronto, Ont.

The Bell Telephone Co. has purchased a site on Dufferin and Bloor St., for the erection of an exchange.

Tenders will be received by the Hydro-electric Power Commission until 4 p.m. May 18th, for the construction of dams; head-works, etc., and for the excavation of a canal in connection with the power development at Eugenia Falls.

Vancouver, B.C.

The installation of ornamental street lighting on Seymour St., at a cost of $12,560, is recommended by the Light Committee.

Wapella, Sask.

Tenders will be received by Walter Miller, Sec.-Treas. Brookside Rural Telephone Co., P.O. Box 133, Wapella, until May 15th, for the construction and supply of material for a telephone system.

Winnipeg, Man.

Tenders will be received by the Board of Control until May 23rd, for the supply of 2 or 3 induction regulators. Specifications are at the office of the engineer, J. G. Glassco, 54 King St.

CONTRACTS AWARDED

Edmonton, Alta.

The following contracts for telephone supplies have been awarded by the city council. Gorman Clancey & Grindley, Jasper Ave., Northern Elec. Co., 511 Tegler Block, Canadian General Elec., Credit Foncier Block, Canadian Oil Co., Ltd., Columbus Ave., Richards Elec. C. Metals Ltd., 4 th St. and Athabasca Ave.

Miscellaneous

Chatham, Ont.

A by-law will be submitted to the ratepayers for authority to raise the sum of $6,000 for the purchase of motor or horse truck equipped, hose, etc., for the fire department.

Calgary, Alta.

The city council have been recommended to accept the contract of the Producers Sand & Gravel Co., for the supply of 30,000 yds. of sand and gravel, at $1.65 per yd.

Hamilton, Ont.

The ratepayers will be asked to vote on a by-law before June 1st regarding the proposed purchase of the quarry at a cost of $75,000.

Regina, Sask.

The gas system by-law having been carried the general contractors, McAuley Co., of Calgary, will commence digging wells in about a month's time.

Stratford, Ont.

A by-law for authority to expend the sum of $17,250 on additional fire equipment will be submitted to the ratepayers May 18th.

St. Helens, Ont.

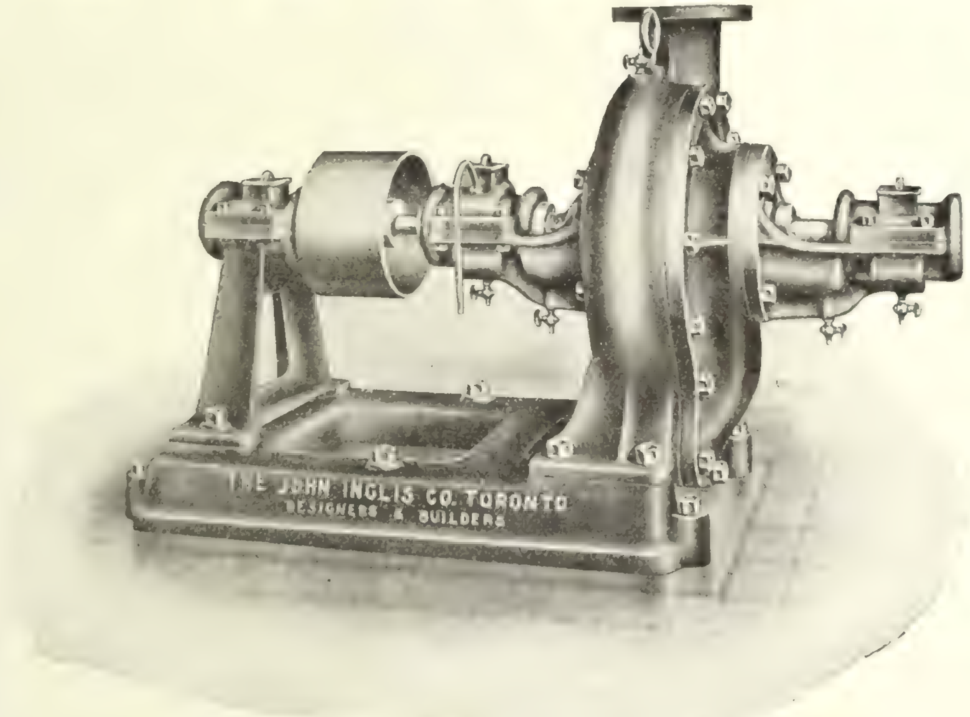
Messrs. Todd & Joynt are asking for prices on all sawmill machinery for equipping heading mill, also for a 40 or 45 h.p. engine.

CONTRACTS AWARDED

Calgary, Alta.

The city council has awarded a contract to the Canada Cement Company,

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

[illegible] Elma Block, for the supply of 60,000 bbls. of cement.

Medicine Hat, Alta.

A contract for the drilling of 10 gas wells has been let by the Saskatchewan Gas Co., Regina, to the International Supply Co.

Winnipeg, Man.

The gas holder contract has been awarded by the Board of Control to the Manitoba Bridge & Iron Works, Ltd., Logan Ave. W.

Business Notes

Amherst, N.S.

The business block owned by Dr. J. R. Gilroy has been destroyed by fire. The loss is estimated at $10,000.

Gluchen, Alta.

The Sarnia Livery Stables have been destroyed by fire. The loss is placed at $15,000.

Macoun, Sask.

C. Hochan's hotel was recently completely wrecked by an explosion. The loss is about $10,000.

Sarnia, Ont.

Mr. H. A. McLean, town engineer, has recently placed an order with the Herbert Morris Crane & Hoist Company, Limited, for one of their standard type G hand-operated overhead travelling cranes. This crane will have a capacity of 10 tons and a span of 49 ft. 3 in. The crane is to be used in the new power house at Point Edward and we understand that the placing of the order was influenced by the satisfactory service given by another Morris crane in Sarnia at the plant of the Sarnia Gas & Electric Light Company, Limited.

Sault Ste. Marie, Ont.

The city has placed an order for the erection of a 20-ton incinerator plant with the A. H. Reid Incinerator Company, of Toronto.

St. John, N.B.

A disastrous fire has destroyed the premises and machinery of the Christie Wood Working Company, Limited. The loss is estimated at $60,000, $20,000 of which is covered by insurance.

New Companies

Polson Dry Dock & Shipbuilding Co., Ltd., has been incorporated with a capital of $2,000,000, with head office at Toronto.

The Lancaster Water Works, Ltd., has been incorporated with a capital of $20,000, with head office at Lancaster, Ont. The provisional directors are J. A. Bourbeau, Montreal; and A. Powell, T. Aubry, D. P. J. Tobin, and J. A. Taillon, all of Lancaster, Ont.

A. Barnet & Company, Limited, has been incorporated with a capital of $250,000, with head office at Renfrew, Ont., to carry on business as lumber merchants. The provisional directors are A., J. E. H., T. F., and J. G. Barnet, of Renfrew, Ont., and J. C. Browne, Ottawa, Ont.

Thomas Reinforced Concrete Co., Ltd., has been incorporated with a capital of $50,000, with head office at Walkerville, Ont. The provisional directors are, A. Thomas, G. B. Wadham, Jr., and A. A. Stibbard, of Detroit, U. S. A., W. Woollatt, of Walkerville, Ont., and A. B. Drake, of Windsor, Ont.

Canadian Zagelmeyer Co., Ltd., has been incorporated with a capital of $30,000, with head office at Windsor, Ont., to carry on buisiness as manufacturers of cement block moulds, and dealers in cement products. The provisional directors are L. H. Walker, P. Zagelmeyer, A. Kolb, and F. Zagelmeyer, all of Bay City, U. S. A.

Bowlby Sand, Lime, Brick Co., Ltd., has been incorporated with a capital of $100,000, with head office at Milton, Ont. The provisional directors are R. Bowlby and R. Boyd, of Toronto, and W. I. Dick, of Milton, Ont.

Universal Tool Steel Co., Ltd., has been incorporated with a capital of $10,000,000, with head office at Toronto. The provisional directors are G. Ruel, R. H. M. Temple, A. J. Reid, W. L. Pinkney and F. C. Allen, all of Toronto.

Electric Furnace Products Co., Ltd., has been incorporated with a capital of $5,000,000, with head office at Toronto. The provisional directors are H. E. Wallace and R. Pike, both of Toronto.

Dominion Engineering and Machinery Co., Ltd., with a capital of $2,000,000, with head office at Toronto. The provisional directors are G. M. Kelley and J. D. Falconbridge.

The Corbett Contracting Co., Ltd., has been incorporated with a capital of $100,000, with head office at Welland, Ont. The provisional directors are J. H. Corbett, Edward Corbett and J. Henry Corbett, of Welland, Ont.; H. A. Corbett, of Fredericton, N.B., and E. S. Skead, of Hull, Que.

Downing-Cook Co., Ltd., has been incorporated with a capital of $50,000, with head office at Montreal, to carry on business as general contractors. The provisional directors are W. R. L. Shanks and D. P. Gillmor.

Canadian Expansion Bolt Co., Ltd., has been incorporated with a capital of $40,000, with head office at Toronto. The provisional directors are J. A. Kent, J. H. McDonald and E. W. Wright, of Toronto, and G. P. Robinson and L. R. Zifferer, of New York, U.S.A.

The Toronto and Hamilton Electric Co., Ltd., have been incorporated with a capital of $200,000, with head office at Hamilton, Ont. The provisional directors are R. Lynch, R. Crompton, H. E. Job and L. F. Stephens, all of Hamilton, Ont.

Driftwood Lands and Timber, Ltd., has been incorporated with a capital of $150,000, with head office at Toronto. The provisional directors are J. L. Ross and A. W. Holmstead.

V. I. Contractors Supply Co., Ltd., has been incorporated with a capital of $10,000, with head office at Victoria, B.C.

The Grand Forks Concrete Co., Ltd., has been incorporated with a capital of $10,000, with head office at Grand Forks, B.C.

The Selkirk Power Co., Ltd., has been incorporated with a capital of $35,000, with head office at Vancouver, B.C.

Huntting Merritt Lumber Co., Ltd., has been incorporated with a capital of $100,000, with head office at Vancouver, B.C.

Mitchell Lumber Co., Ltd., has been incorporated with a capital of $25,000, with head office at Vancouver, B.C.

Giffin and Company, Limited, has been incorporated with a capital of $40,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are J. H. Parmenter, A. J. Thomson and W. S. Morlock, all of Toronto.

Kootenay Granite and Monumental Co., Ltd., has been incorporated with a capital of $50,000, with head office at Nelson, B.C.

Burrard Engineering Co., Ltd., has been incorporated with a capital of $100,000, with head office at Vancouver, B.C.

Brick manufacturers in Manitoba are awaiting with interest the results of the experiments being carried on at the plant of The Sidney Brick & Tile Company, Limited, at Sidney, Manitoba. One of the greatest difficulties in the process of manufacturing brick is to be able to utilize cheap fuel. Those plants situated in places surrounded by coal areas have little concern in this regard. In Manitoba, however, where fuel, both coal and wood, are almost prohibitively expensive, brick manufacturers are faced with the difficulty of reducing the cost per thousand brick for burning to some reasonable figure. The nearest coal supply for Manitoba brick industries is to be found in southern Saskatchewan, but unfortunately the quality of the coal, as to its heat producing power, is very poor, and the freight rates to Manitoba points are excessive. The Sidney Brick & Tile Company, Limited, is installing a gas producer plant, which it is hoped will be able to utilize to the fullest degree the heat units latent in Souris lignite coal.

The problems of building construction in India are described in an American consular report, which states that one of the most significant recent developments in connection with the construction of large buildings in India has been the increasing use of American reinforcing steel for concrete construction and of various American roofing materials. Possibly, says the Consul, there would be a field in India for architects and building contractors who might introduce more efficient and economical methods, and thus make buildings cost much less and give more safety and comfort.

Unless all signs fail, 1914 will be equally as good a building year in Medicine Hat as was 1913. The local architects are busy, and plans are being made for a number of large and important structures, to say nothing of hundreds of residences. Among them may be mentioned a technical high school to cost about $300,000; a telephone building to cost $90,000; immigration hall and addition to federal building; two eight-room schools and a primary school, all brick, to cost about $100,000; a factory for the Saskatchewan Bridge and Iron Co., to cost about $100,000; two flour mills, costing not less than $1,000,000; two apartment blocks, to cost about $100,000; fire halls, valued at $80,000, on which work has been started; hospital and convent, to cost $100,000; a radiator factory, upon which $100,000 will be expended; two six-storey business blocks, each to cost $200,000, and several structures of lesser importance, including the many homes that will be constructed, and some of which are already under way.

SUN-TEX
Clay Products
for permanent results

¶ Dark Red stock Sun-Tex Brick was used throughout in the construction of the picture theatre illustrated, which has been erected on Roncesvalles Avenue, Toronto.

¶ Should you happen to visit this new theatre, or be passing by, just note the solidity and even finish of the brick.

¶ Sun-Tex Brick is hard and dense and possesses uniformity of size, color and quality.

Let Us Quote You Prices

SUN BRICK COMPANY, LIMITED

Traders Bank Building - - - - TORONTO

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

220 King Street West, Toronto

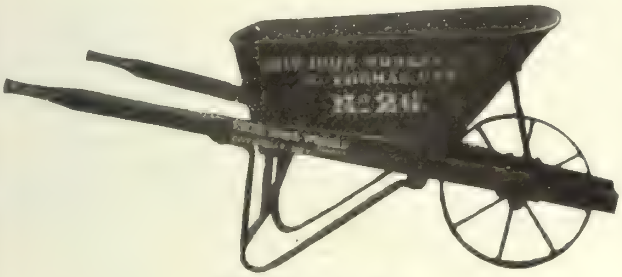
Electric Steel Castings

Our Welland plant will be ready to furnish ***Carbon, Manganese, Alloy Steel Castings*** and ***Forging Ingots,*** by the end of May, made by the Electric Furnace process.

This process makes a dependable high grade steel and steel casting, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars

The Electric Steel & Metals Co., Ltd.
Welland, Ontario



ERIE
Concrete Wheelbarrow

THIS barrow specially suited to handling concrete. The tray is welded steel without rivets and is absolutely watertight.

The legs are made of channel iron and thoroughly braced.

The wheel is guarded and the barrow may be dumped forward or at sides.

Write us for prices.

The Erie Iron Works, Limited
ST. THOMAS, Ontario.

Standard White Lime Co.
GUELPH, ONT.

manufacturers of high calcium and magnesia lime.

Works at Guelph, Brockville and St. Marys.

We make a specialty of

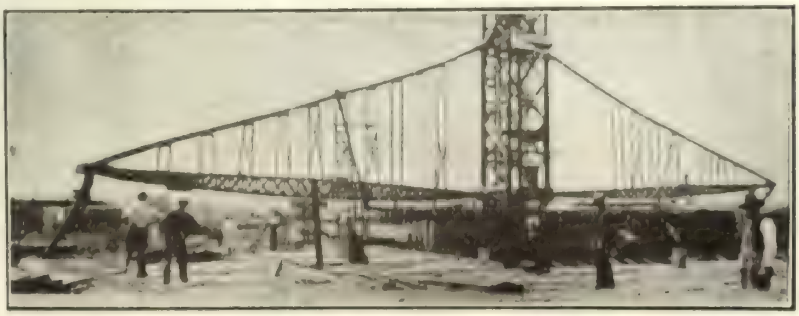
Hydrated Lime

You always have fresh lime when you use Hydrate.

Head Office - GUELPH

Write us for further information

Gravity System Distributing Concrete



Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.
Sole Licencees for Canada

613 Vancouver Block,
VANCOUVER
B. C.

Eastern Representatives
Stinson Reeb Builders' Supply Co., Ltd.
Montreal, P. Q.

For Sale

- 1 Dumping cradle cableway. 2 spans, 1100 feet each—complete, in perfect working order.
- 1 Model 60 Marion steam shovel, used one season.
- 2 Improved style "A" Marion shovels.
- 2 Locomotives, consolidation type. Cylinders 20" x 26".
- 1 Standard gauge locomotive. Cylinder 18" x 26".
- 4 Saddle tank dinkies, standard gauge. Cylinders 10" x 14".
- 50 4-yard, two-way, standard gauge dump cars, $52.00 each.

This equipment is in perfect condition. Immediate shipment.

W. FRASER, 83 Craig St. West, MONTREAL
P. O. Box 792

County Academy,
Sydney, N.S.

Butler and McDonald
St. Johns, N.F.

This building is sound-proofed with

CABOT'S DEAFENING "QUILT,"

"the most perfect deadener made." Not a mere felt or paper, but a thick, quilted cushion which absorbs and dissipates the sound-waves. Proof against moths, vermin and decay, and uninflammable.

Special book on School-house deafening, with twenty plates of buildings, and samples of Quilt, sent on request, free.

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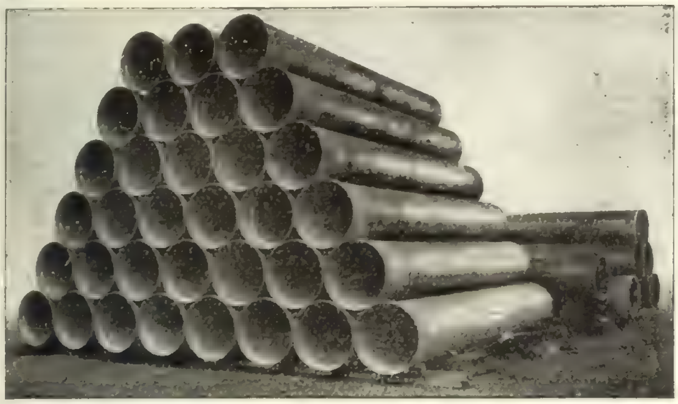

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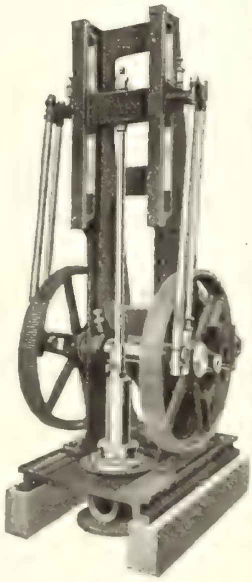

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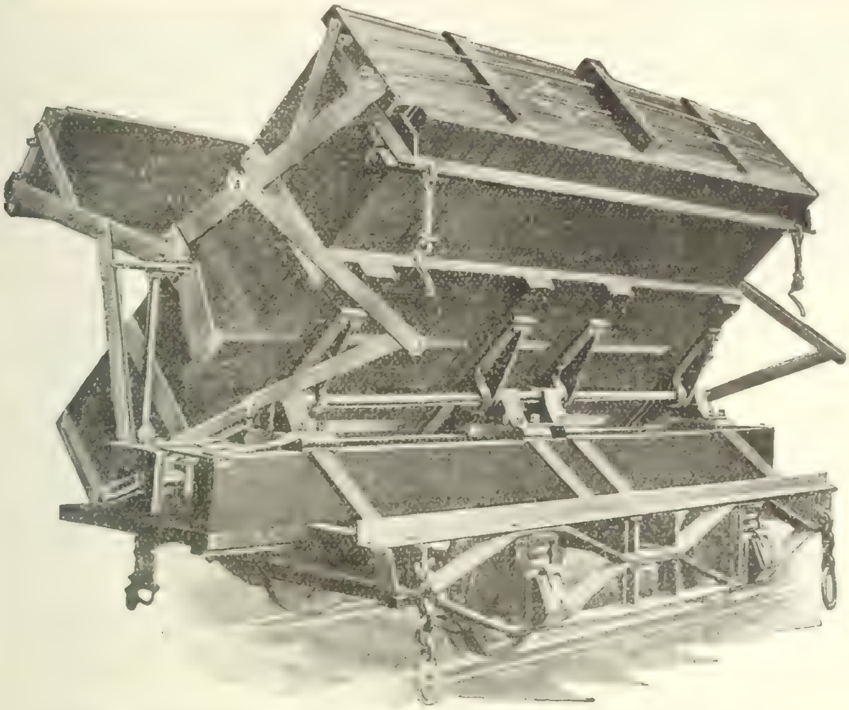

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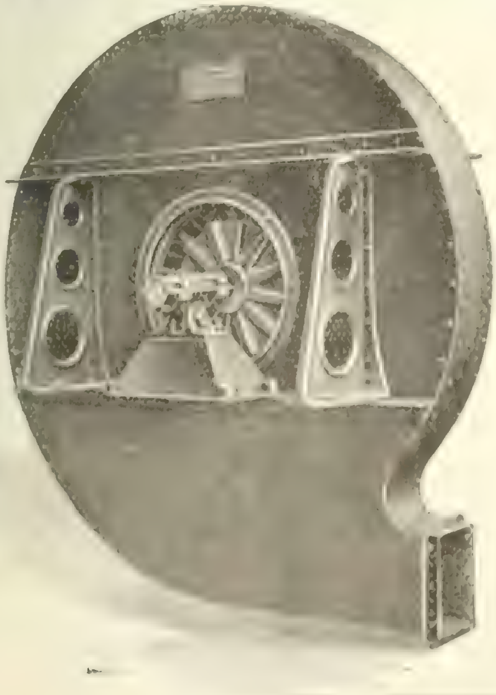

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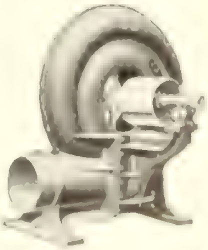

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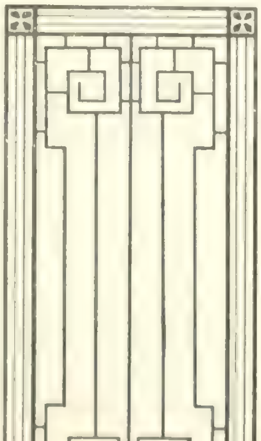

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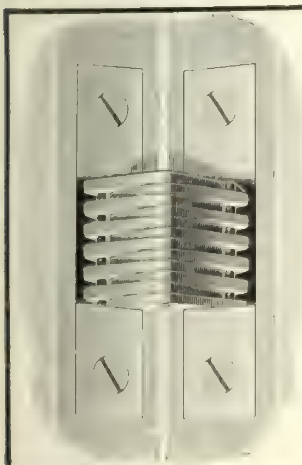

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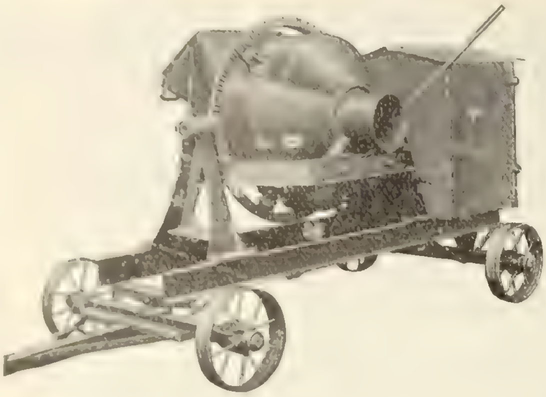

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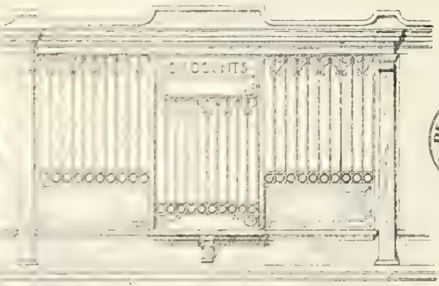

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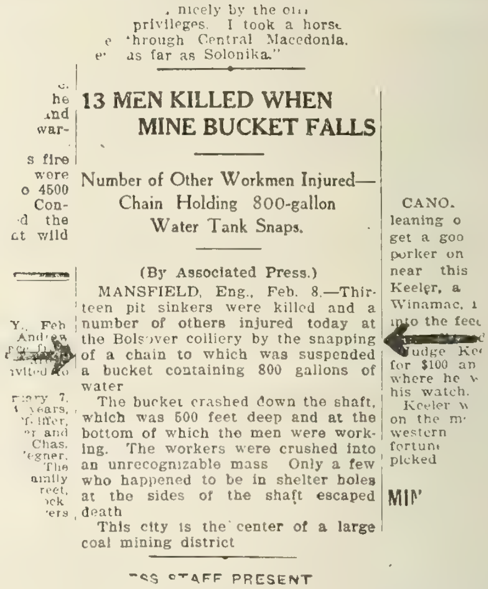

, nicely by the old
privileges. I took a horse
through Central Macedonia.
as far as Solonika."

13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

(By Associated Press.)

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This city is the center of a large coal mining district

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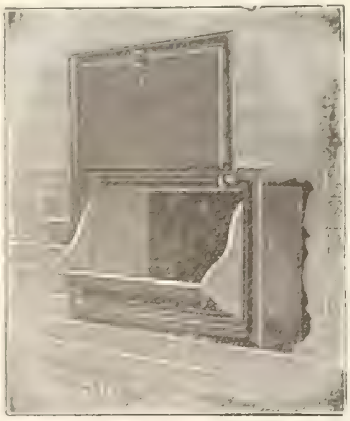

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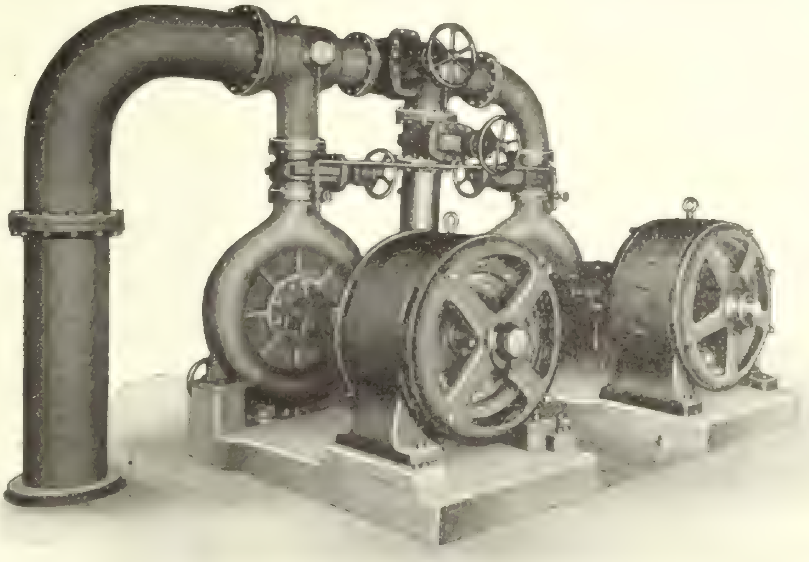

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The Right Quality
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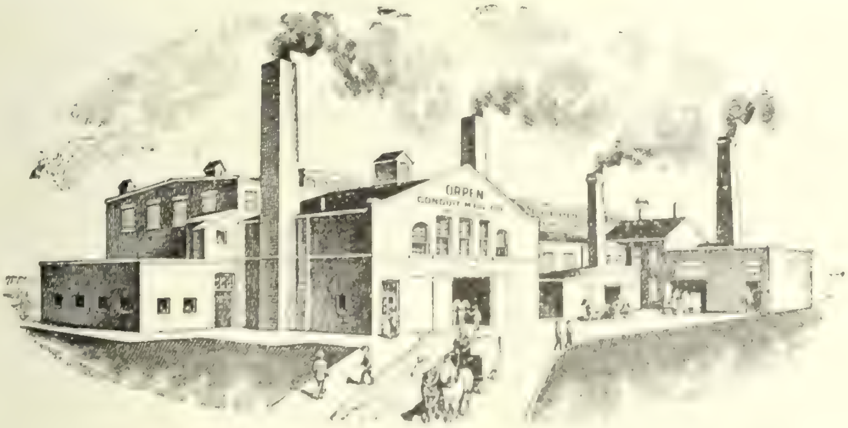

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"Xceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

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GALVANIZED WIRE-WOUND for waterworks systems, irrigation, etc.

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COSTS LESS THAN IRON OR STEEL AND AS DURABLE.

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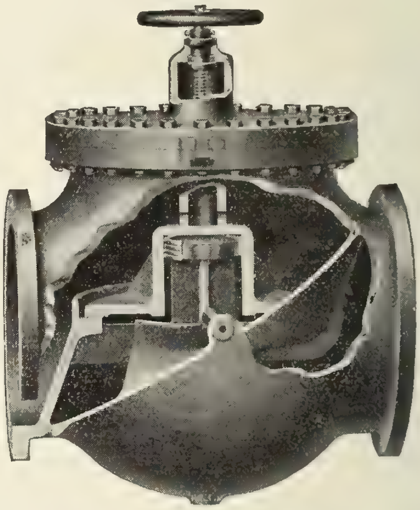

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LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

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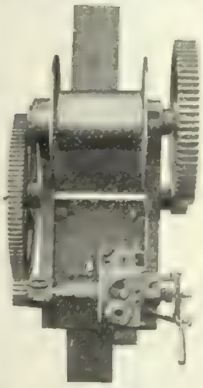

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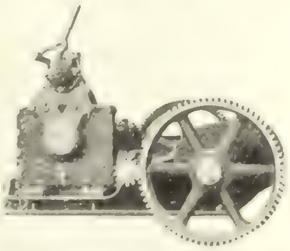

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every size for Water, Gas, Culvert or Sewer, Carried in Stock

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Build into every structure the rich, un-fading RED of the finest facing brick ever produced.

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"BRADFORD REDS"

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460 feet x 8 feet 2 in.

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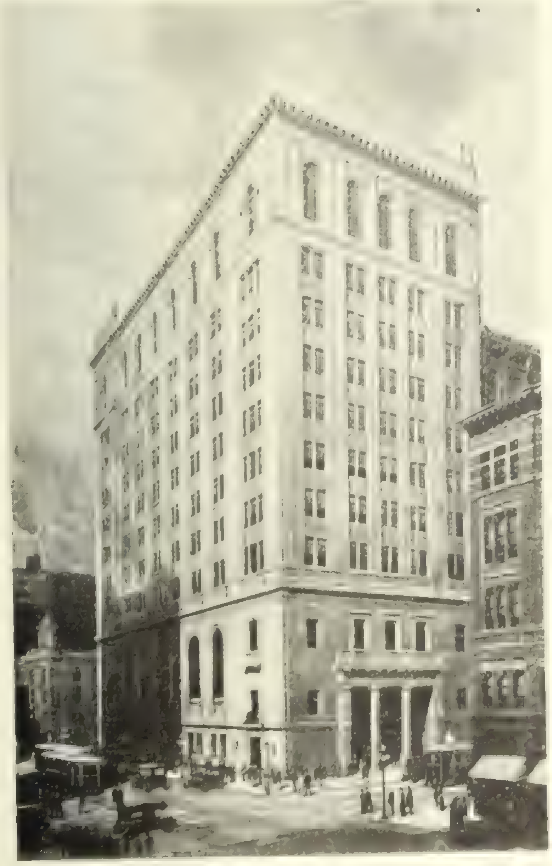

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1,000 to 1,000,000 Gallons a Day

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1/4 to 60 Ton Daily Capacity

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THE above three brands of Common brick are burned in the newest and most modern down-draft, continuous coal-burning kilns. "Beaver," "Scotia" and "Acadia" brands of Common brick are uniform in size and quality.

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makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely ***weather and fire proof.***

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Work of all kinds

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Determine that you will take no more chances on the materials you use. Decide right now that there is but one class of goods which will reflect credit on the work you do.

Some one has said that the best Advertisement a man can have is "Work done well"—we might add "With 'Metallic' Materials."

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Towers and Tanks for all purposes.

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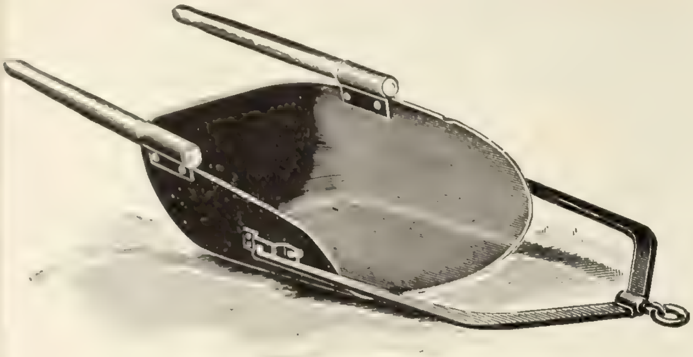

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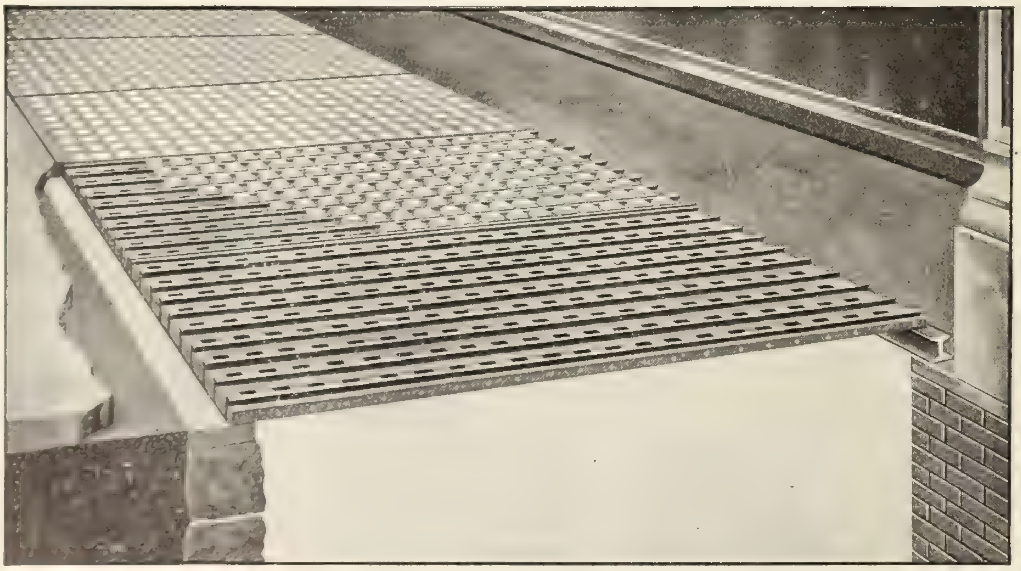

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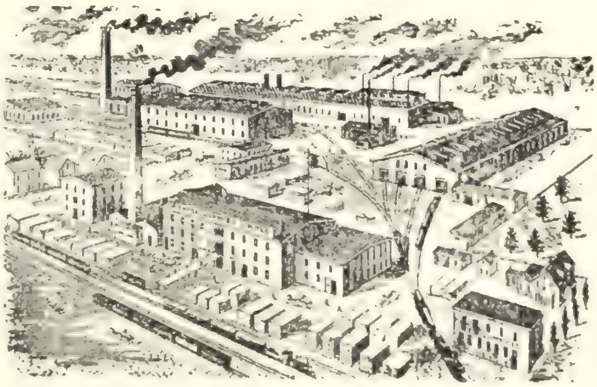

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In addition to our large stock of native lumber, we are now carrying about one million feet of foreign lumber, including oak, walnut, ebony, whitewood, basswood, red cedar, Douglas fir, mahogany, &c.

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Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

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FIRE BRICK **IVORY CEMENT PLASTER**

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Current Prices of Building and Engineering Materials

CEMENT, LIME, AND BRICK

Toronto prices (wholesale) delivered:

Cement—[illegible] in 5 barrel lots, $1.85 per bbl.; car lots, $1.55. Pkgs extra.

Lime—grey 35c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the [illegible], white [illegible], grey 35c.

Brick—No. 1 dry pressed red and buff brick, $18, common red stock brick, $13 to $15; grey, $11.50 to $12; wire cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to [illegible], sand lime brick (a) $8.10, King Edward siding, (b) $10.50 delivered on the job. paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M; No. 2, $18. Brick 2½ x 4 x 8½ in., blocks 3½ x 4 x 8½ in.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

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Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

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Toronto prices, delivered on the job:

Steel—(round and square bars) $2.10, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

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Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement $1.35 to $1.50 per bbl., f.o.b. cars, bags 10c; $1.80 l.c.l., bags extra.

Lime Hydrated, $14 per ton; lump, $10.

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Crushed Stone 2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand $1 per ton, car loads, on cars.

Gravel—$1.35, f.o.b. cars.

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Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—P-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. Copper bearing sheets—flat, Apollo keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

SStraight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bands, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

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Hard wall plaster—$10.50 per ton. Plaster of Paris—$2.35 per bbl. Rope—British Manilla, 15c pasis per pound; second grade, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 67c per gal. of 9 lbs. Raw linseed oil—in barrels, 64c per gal.

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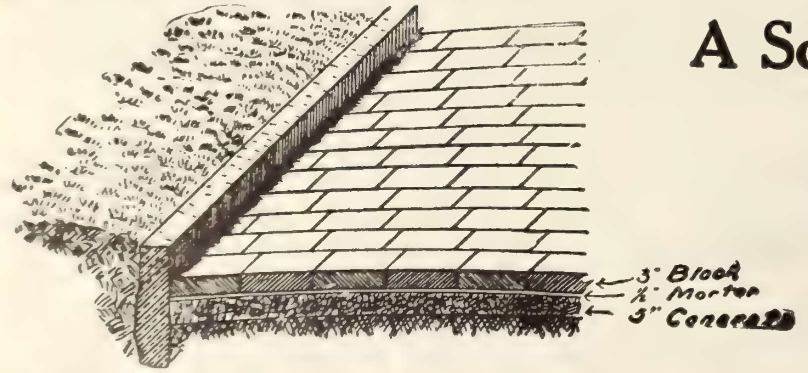

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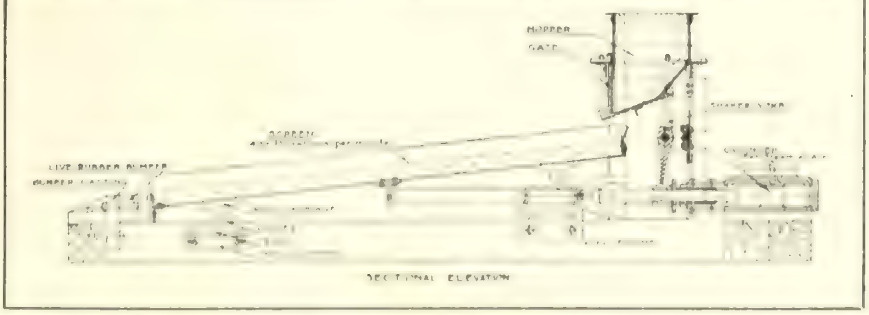

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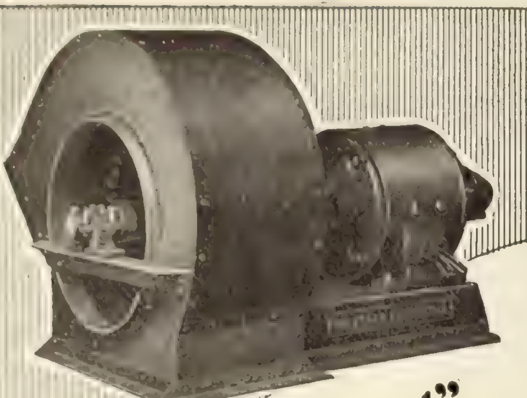

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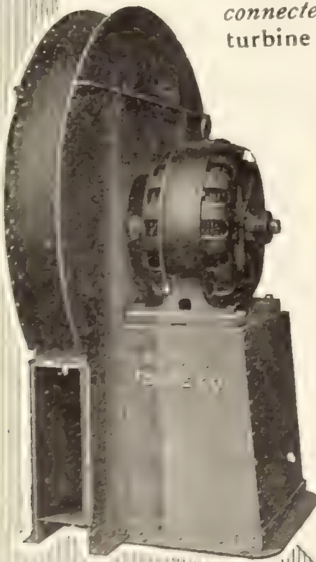

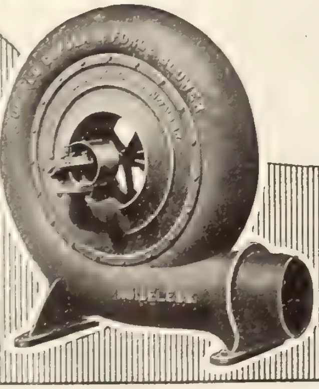

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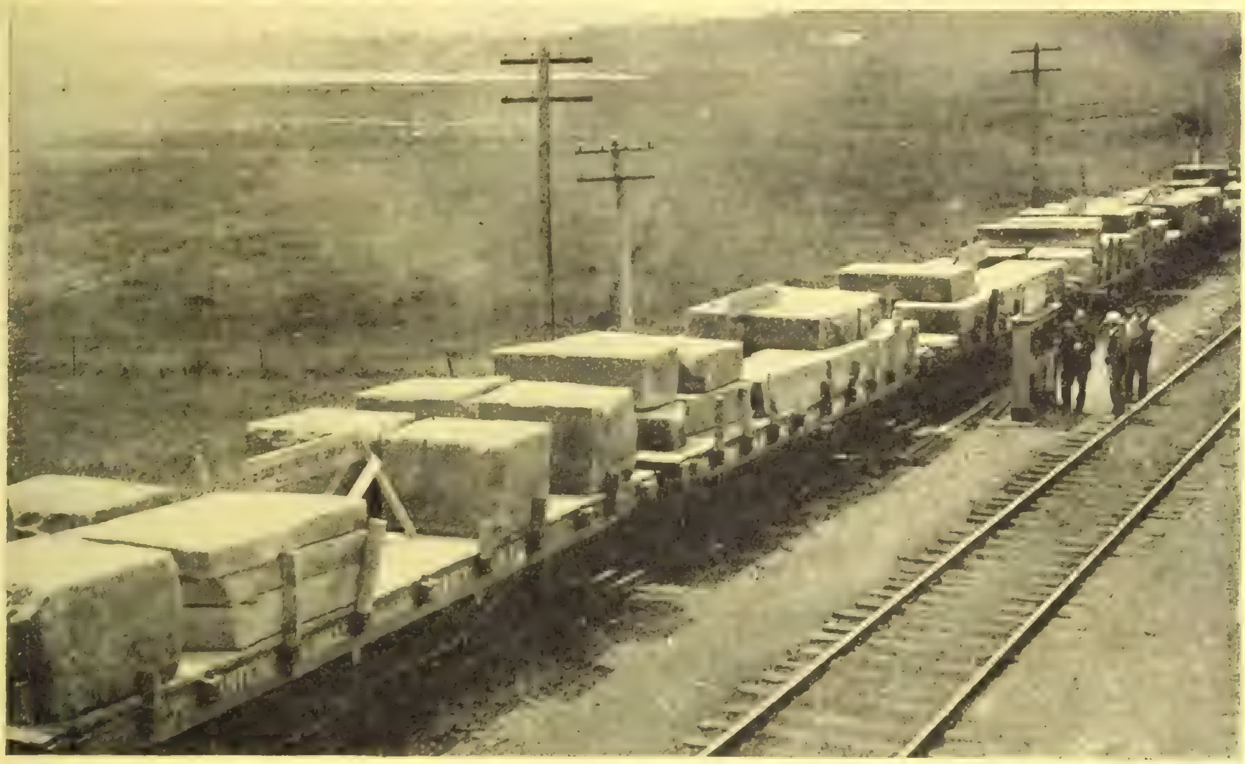

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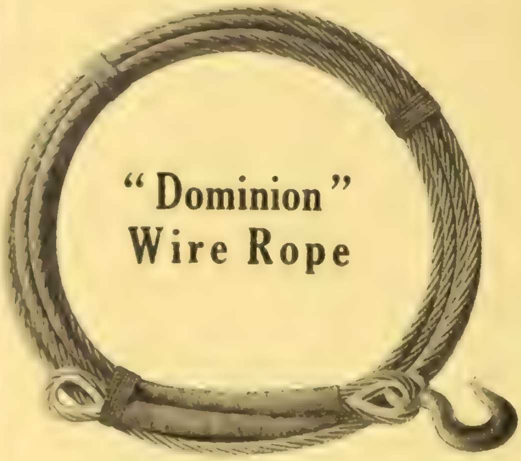

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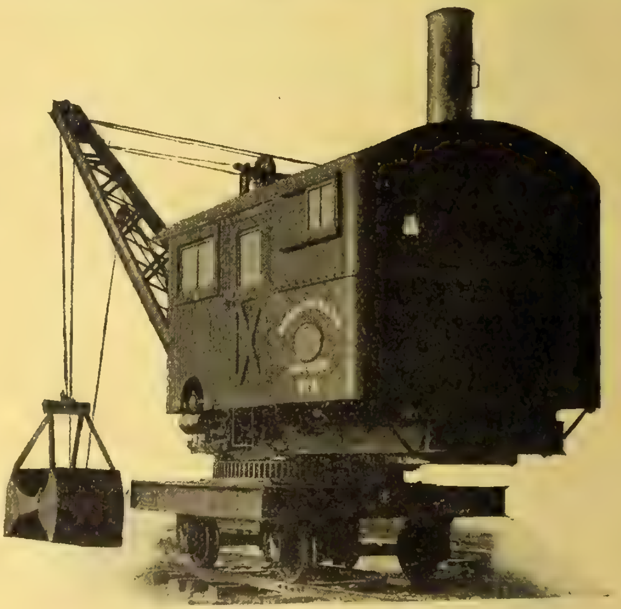

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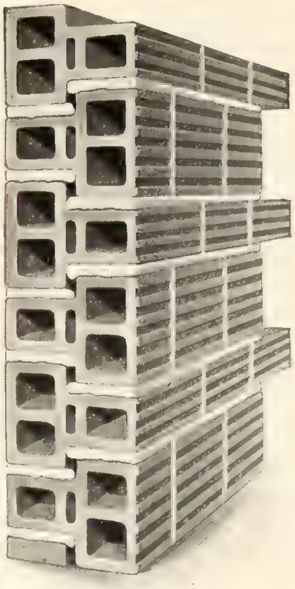

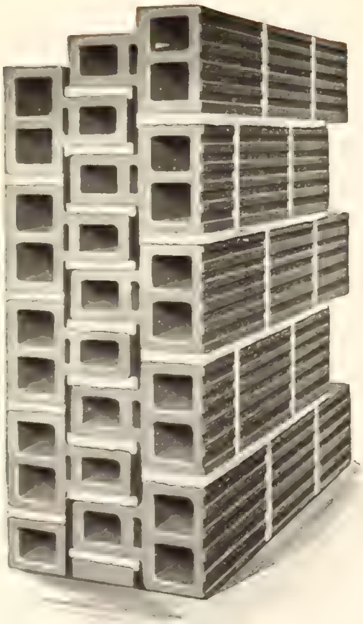

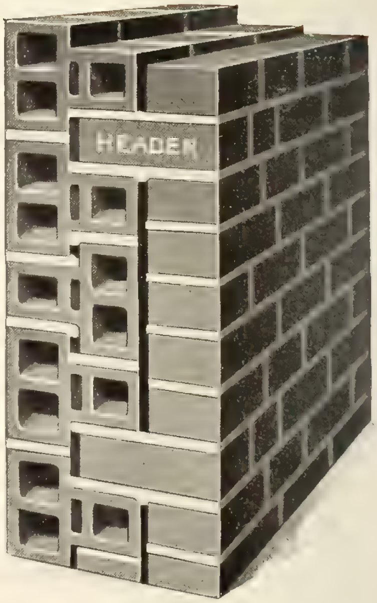

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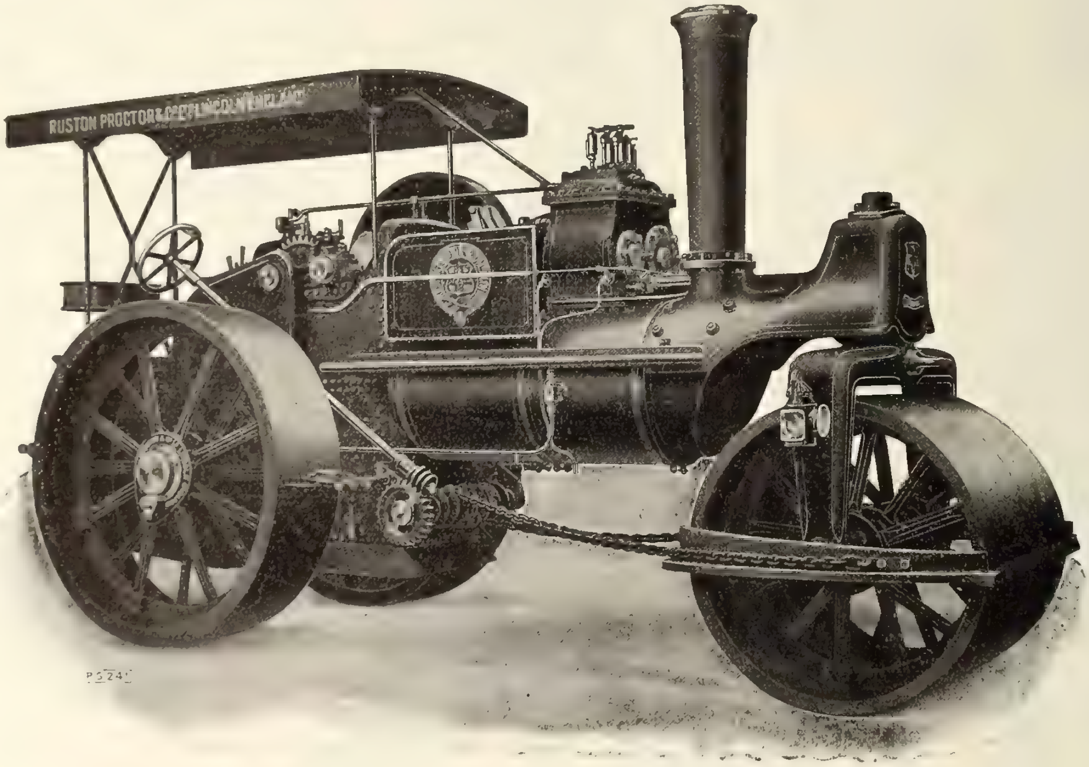

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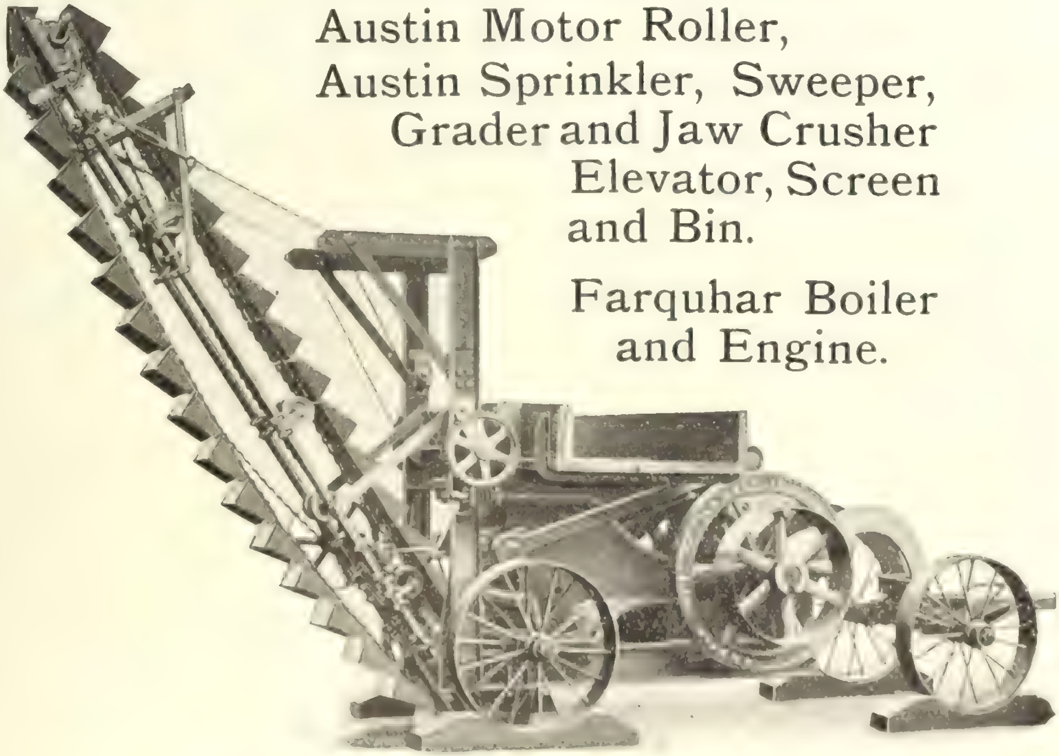

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  Morris Machine Works.
  Municipal Engineering & Contracting Co.
  Montreal Locomotive Works
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  Parsons Company, G. W.
  Royce Limited
  Sauerman Bros.
  Schell Foundry & Machine Co.
  Stinson-Reeb Builders' Supply Co.
  Sudbury Construction & Machinery Co.
  Stratford Mfg. Company
  Tiffin Wagon Works.
  Wettlaufer Bros.

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  Conduits Co., Limited
  Orpen Conduit Mfg. Co. of Can.
  Ric-Wil Underground Pipe Covering Co.

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  Erie Iron Works
  Meaford Wheelbarrow Co.

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  Golden Anderson Valve Co.

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  H. A. Barnard
  Sudbury Construction & Machinery Co.

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  Sturtevant Co. of Can. Ltd. B. F.
  Sutcliffe, Speakman & Co.
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  Can. H. W. Johns-Manville Co.
  Metallic Roofing Co.
  Ormsby, A. B., Limited
  Pedlar People Limited.

Cranes, Travelling and Locomotive
  American Hoist & Derrick Co.
  W. D. Beath & Son
  Browning Company.
  Brown Hoisting Machinery Co.
  Morris Crane & Hoist Co., Herbert.
  Northern Crane Works.
  Rock & Power Machinery, Ltd.
  Roelofson Elevator Works.
  Royce Limited

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  Cabot, Inc., Samuel

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  Gravel Sand & Crushed Stone Co., Ltd.
  Hagersville Contracting Co.
  Ontario Lime Co., Ltd.
  Rogers Supply Company
  Smyth & Ryan

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  Goodwin, Barsby & Co.
  Hamilton Mfg. Co., Wm.
  Hopkins & Co., F. H.
  Jenckes Machine Co.
  Lecky & Collis
  London Concrete Machinery Co.
  Mussens Limited
  Rock & Power Machinery
  Sutcliffe, Speakman & Co.
  Wettlaufer Bros.

Culverts
  Pedlar People.

Cupolas (Foundry)
  Northern Crane works

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  Mannesmann Tube Co.

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  American Hoist & Derrick Co.
  Beath & Son, W. D.
  Hepburn, John T.
  Sasgen Derrick Company
  Woodside Bros.

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  Beatty & Sons, M.
  Browning Company.
  Morris Machine Works.

Drills
  Beatty & Sons, M.
  Canadian Allis-Chalmers, Ltd.
  Canadian Buffalo Forge Co.
  Canadian Ingersoll-Rand Co.
  Lecky & Collis
  Star Expansion Bolt Co.

Drill Steel Sharpeners
  Canadian Ingersoll-Rand Co.

(Continued on page 10)

Tarvia

Preserves Roads
Prevents Dust~

St. Viateur Street, Outremont, Quebec. Constructed with Tarvia Modern Pavement.

Outremont's Experience with Tarvia

LIKE many another progressive town, Outremont wanted a main street that would be free from dust and mud and have the cleanliness and sightliness of a city type of pavement without high cost. Ordinary macadam would not do, for ordinary macadam is unfit for modern traffic.

Accordingly, Outremont in 1911 paved St. Viateur Street, as illustrated above, with tarviated macadam according to the modern pavement specification. The construction of the roadway cost less than $1.00 per square yard, including everything. The above photograph, taken in 1913, shows the road after two years' wear, still in ideal condition. There have never been any repairs to this street; the maintenance cost so far has been nothing.

The ideal method of maintaining this street in the same excellent condition will be to restore the surface when it gets worn by a light coat of "Tarvia B" and stone screenings. With such an occasional treatment, this road—bonded and maintained with Tarvia—will give Outremont an ideal pavement for many years to come, at an annual average maintenance expense no higher than the expense for plain macadam.

Tarvia is a dense, viscid, waterproof coal tar product of great bonding power. It changes macadam into a tough Tarvia concrete which is automobile-proof and storm-proof. Tarviated roads are everywhere replacing old style macadam.

Is your town in line?

Booklets on request.

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MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
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is the keynote of the great success of

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Refined by U. S. Asphalt Refining Co., New York

Aztec is a genuine Asphalt Product, without the admixture of any inferior materials. It is refined by careful and scientific processes which produce an asphalt thoroughly uniform in character and which passes the highest tests in every essential qualification necessary to a high grade asphalt.

"Aztec Asphalt in New York, Philadelphia and Other Places"

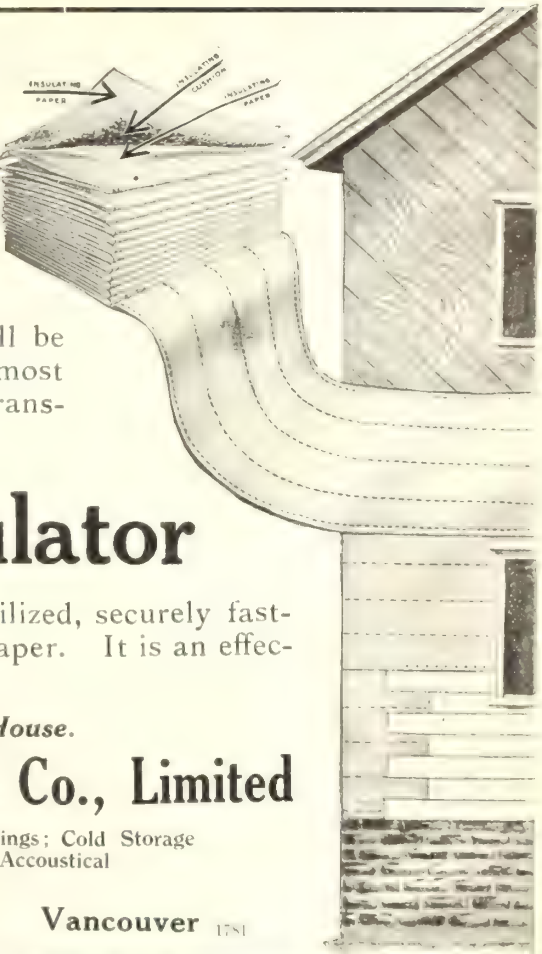
is the name of a little Booklet that is proving of great interest to a whole lot of Highway officials, Engineers and Contractors. Suppose we put down your name on our mailing list for this Booklet and for the other data we stand ready to present, covering fully both Aztec Asphalt for Streets and Highways, and Aztec Liquid Asphalt, for Oiling Roads. Write us.

Aztec Oil & Asphalt Refining Co.

of Canada

926 Power Building, Craig Street, Montreal

Your Clients' Comfort Brings More Business



Every client that you satisfy will sell your services to his friends. And there is no more certain way of satisfying your clients with the way you insulate their buildings than by specifying that Keystone Hair Insulator shall be used between the walls and floors. That Keystone is the most efficient material for deadening sound and preventing the transmission of heat and cold we can quickly prove to you.

Keystone Hair Insulator

consists of a heavy layer of cattle hair, cleansed and sterilized, securely fastened between two sheets of strong, non-porous building paper. It is an effective fire retardant. Is inodorous and vermin proof.

Get samples and catalog from our nearest House.

The Canadian H. W. Johns-Manville Co., Limited

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

Manufacturers of Asbestos Roofings; Stucco; Pipe Coverings; Cold Storage Insulation; Waterproofing; Sanitary Specialties; Accoustical Correction; Cork Tiling, etc.

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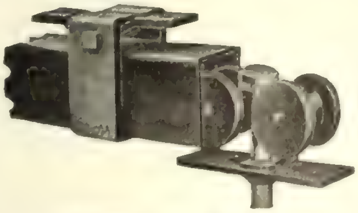
"A HANGER FOR ANY DOOR THAT SLIDES"



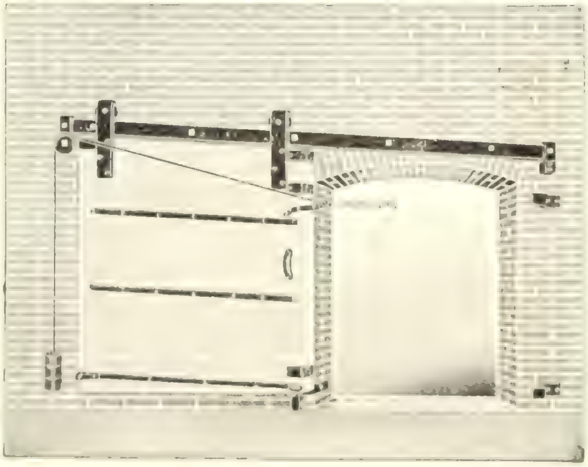
Folding Door Hanger.
Forged Steel Ball Bearing.

Trolley Hanger 150 B
Forged Steel Ball Bearing
Vertical and Lateral Adjustment.

There is a right hanger for every purpose, in the Richards - Wilcox line, and conscientious builders always want the "one right thing."

Our catalogue (mailed on request) enables you to select this one right hanger and to avoid the common mistake of hanging doors on hardware that is too light or not adapted to the purpose.

We recommend the trolley hanger for all purposes except fire doors. Consult us about any special equipment you may need.



UNDERWRITERS INSPECTED HARDWARE LABORATORIES

FIRE DOOR HARDWARE.
Swing, Slide and Vertical types Inspected under the supervision of Underwriters' Laboratories bear their label.

Richards-Wilcox

CANADIAN COMPANY, LTD.
LONDON, ONTARIO.

R-W R-W

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- Manitoba Bridge & Iron Works.
- Schell Foundry & Machine Co.
- Western Wheeled Scraper Co.
- Weller Mfg. Co.
- Sheldons Limited.

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- Deere Plow Co., John.
- Troy Wagon Works

Drying Apparatus
- Sturtevant Co. of Can. Ltd. B. F.

Electric Fans
- Sturtevant Co. of Can. Ltd. B. F.

Electric Air Rock Drills
- Canadian Ingersoll-Rand Co.

Electric Steel Castings
- Electric Steel & Metals Co.

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- Roelofson Elevator Works.

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- American Enamelled Brick & Tile Company
- National Builders' Supply & Enamel Concrete Brick Co.

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- Boving Company of Canada
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Inglis Co., John
- Jenckes Machine Co.
- Laurie & Lamb
- Leonard & Sons, E.
- McDougall Caledonian Iron Wks.
- Mussens Limited
- Rock & Power Machinery
- Waterous Engine Works Co.
- Wettlaufer Bros.

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- Bowman & Connor
- Campbell, R.
- Chipman & Power
- Dominion Engineering & Inspection Company.
- Farmer, John T.
- Galt Engineering Co., John
- Lea & Ferguson
- Mitchell, C. H.
- Thorold Co., F. W.
- Tyrrell, H. G.

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- Hughes & Lancaster, Limited

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- Austin Drainage Excavator Company, F. C.
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- Municipal Engineering & Contracting Company.
- Parsons Company, G. W.

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- Sheldons Limited

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- Star Expansion Bolt Co.

Expanded Metal
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- Pedlar People Limited.

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- Sturtevant Co. of Can. Ltd. B. F.

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- American Water Softener Co.

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- Ontario Lime Co., Ltd.
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- Mussens Limited
- Pedlar People Limited.
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- British Mfrs. Assn. of Canada.

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- Mills Bros.
- Original Gas Engine Co.
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- Escher Wyss & Co.
- Mannesmann Tube Company.
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- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
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- Morris Hoist & Crane Co., H. bert.
- Mussens Limited
- Rock & Power Machinery
- Royce Limited
- Sturtevant Co. of Can. Ltd., B. F.

(Continued on Page 14)

Brick Today - Stone Tomorrow

Properly made sand lime brick of the best materials will eventually turn to stone under the influence of nature. Those desiring strong and permanent building material should

SPECIFY

"Harbour" Sand-Lime Brick

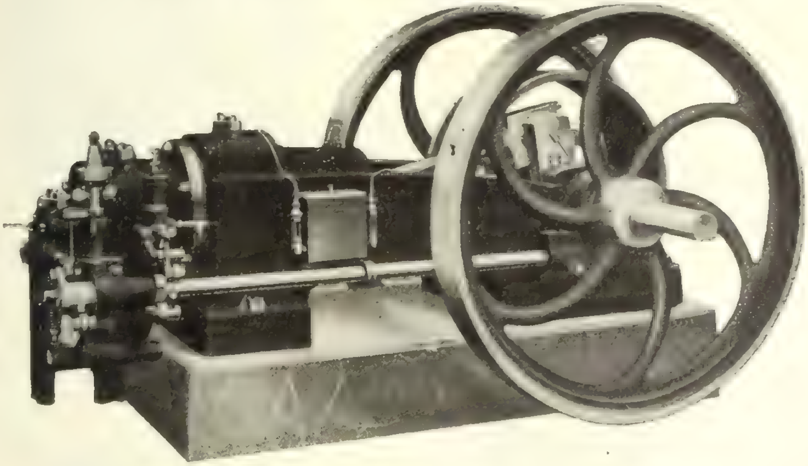
Harbour Brick Company, Limited

50 Front Street E. - - - TORONTO

THE NATIONAL GAS ENGINE CO., L'T'D.

ENGLAND

"NATIONAL" Gas Engines:



Typical Horizontal Single Cylinder, "NATIONAL" Gas Engine

Operated with

SUCTION
PRESSURE
TOWN
NATURAL
COKE OVEN and
BLAST FURNACE
GASES

Horizontal Type from 3/4 H. P. to 450 H. P.

Vertical Type from 350 H. P. to 1,500 H. P. and up.

"NATIONAL" "Gold Medal" Suction Gas Plants

Designed to operate with

ANTHRACITE
GAS COKE
CHARCOAL
SAWDUST
WOOD WASTE
PEAT
SPENT TAN BARK

"NATIONAL" Power Plants are suitable for drives in:

Factories
Shipyards
Bridge Works
Mines
Textile Mills
Quarries
Saw Mills
Flour Mills
Cold Storage Plants
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Laundries
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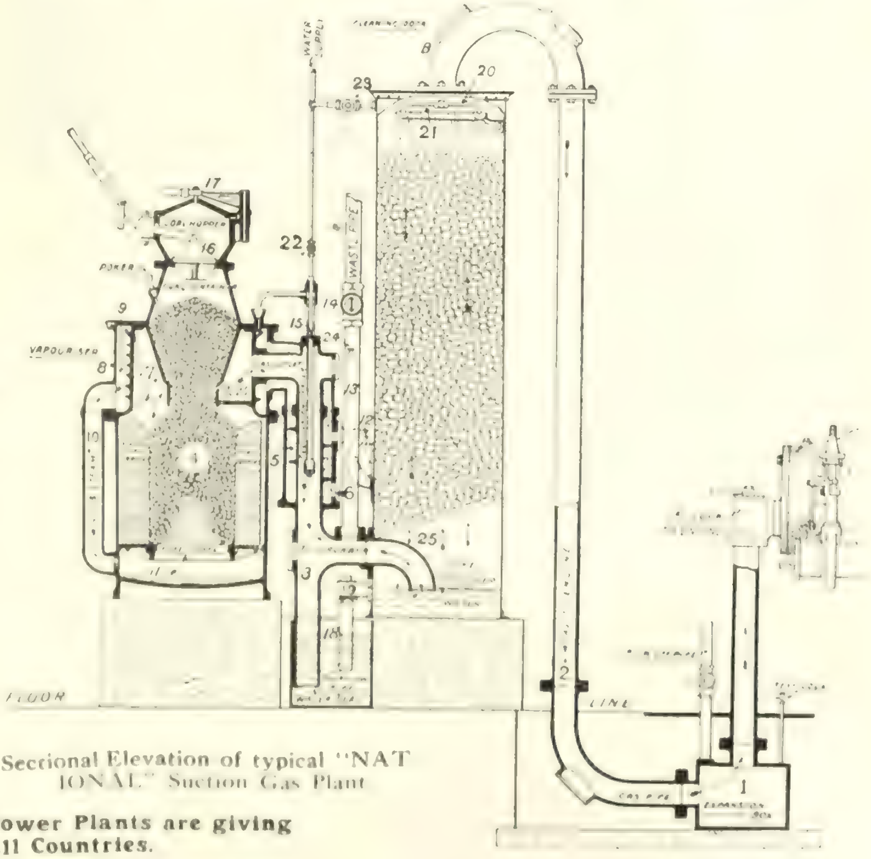
Air Compressors



Sectional Elevation of typical "NATIONAL" Suction Gas Plant

Thousands of "NATIONAL" Power Plants are giving satisfaction in all Countries.

Sole Canadian Agents:

BRITISH MANUFACTURRES' ASSOCIATION OF CANADA, LIMITED 803 McGill Building, Montreal

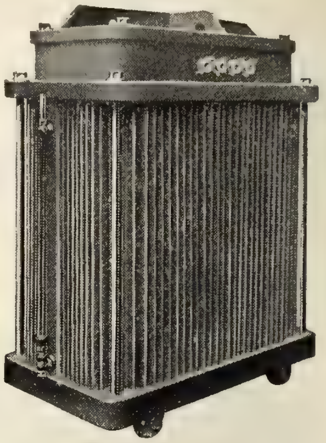
Also Sole Canadian Sales Agents for

Daniel Adamson & Co., steam turbines, rotary blowers, etc.
Adams & Co., "Boa" cleaning waste.
Rochdale Asbestos Co., Limited, packings, etc.
Geo. Shipman & Co., high-speed steel.

WRITE FOR CATALOGS AND ESTIMATES

If You Are Ever in the Market

—for—



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Indicating
Instruments

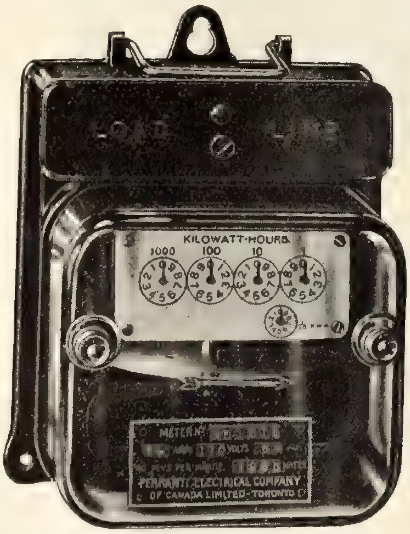
Knife Switches

Fuses

Enclosed Switches

Oil Switches

High Voltage
"Horn" Switches



Indoor and Pole
Transformers

Outdoor
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Motors

Generators

Converting
Machinery

Ferranti Electrical Co. of Canada, Ltd.

Head Office: 90 Sherbourne St., TORONTO
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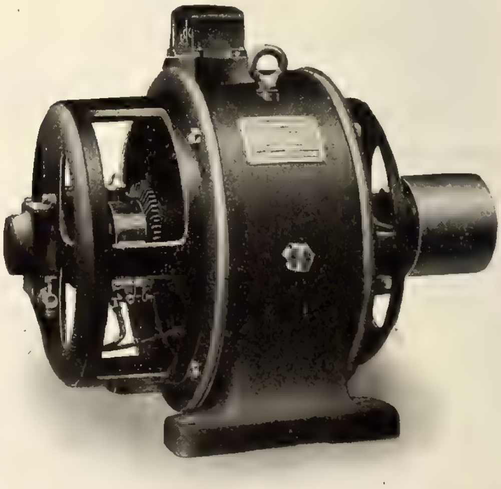


DeLaval

Centrifugal

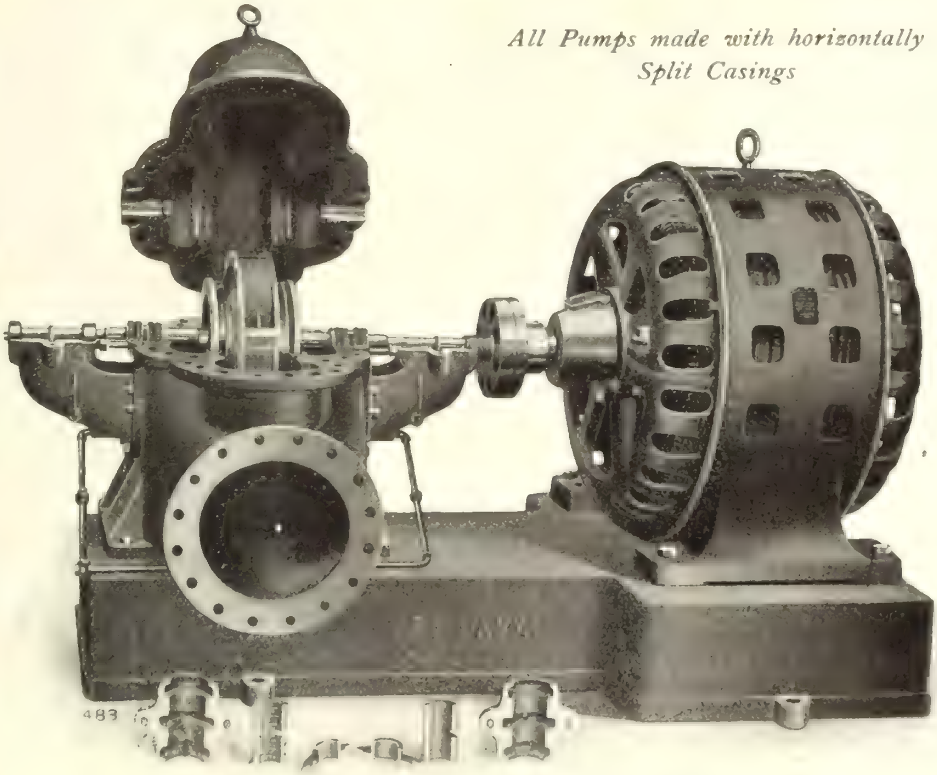
Pumps

All parts made to limit gauges — the only method of ensuring interchangeability

When purchasing Centrifugal Pumps, accessibility should receive as much consideration as efficiency and first cost. Examine the cut, and notice the ease with which the De Laval Pump can be opened up for inspection.

Steam Turbines

Write for Catalogue!

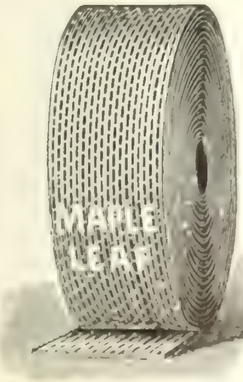


All Pumps made with horizontally Split Casings

Turbine Equipment Co., Limited, 152 Bay St., Toronto

"MAPLE LEAF" BRAND

STITCHED COTTON DUCK BELTING



Excels all others in economy, strength, efficiency and true running, whether for Transmission of Power or Conveying. A test recently made at McGill University, Montreal, of a 6 ply "**MAPLE LEAF**" Belt, light double leather, and a 6 ply rubber belt, showed that our "**MAPLE LEAF**" Belt stood a breaking strain 50% greater than the leather, and 25% greater than the rubber belt.

A trial belt will convince you. Write for samples and prices.

"**MAPLE LEAF**" **Belt Dressing** is the best for all kinds of belts.

Dominion Belting Co. Limited

HAMILTON, CANADA

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  [illegible] Engineering Co.

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  Canadian Sirocco Co.
  Sheldons Limited

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  Northern Crane Works.
  Stratford Mfg. Company

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  Canadian Fairbanks-Morse Co
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  Wettlaufer Bros.

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  Gartshore-Thomson Pipe Co.
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  Morris Crane & Hoist Co., Herbert.

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  Berg Machinery Mfg. Co.

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  Can. Yale & Towne Ltd.

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  Central Locomotive & Car Works
  Canadian Allis-Chalmers, Ltd.
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  Stark Rolling Mill Co.

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  Ferranti Electrical Mfg. Co.
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  Morris Crane & Hoist Co., Herbert.

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  Standard Paint Co.

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  Baker Co., R. D.
  Barber Asphalt Paving Co.
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  Canadian Allis-Chalmers, Ltd.
  Canadian Pipe Co.
  Dominion Concrete Co.
  Gartshore-Thomson Pipe Co.
  Gerald Lomer, Ltd.
  Mannesmann Tube Company.
  National Concrete Mfg. Co.
  National Iron Works
  National Pipe & Foundry Co.
  Pacific Coast Pipe Co.
  Piggott & Co., Thos.
  Steffens & Nolle
  United States Cast Iron Pipe Co
  Vancouver Wood Pipe & Tank Company.
  Walsh Plate & Structural Works.

Partition Hangers
  Springer, O. T.

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  Sutcliffe, Speakman & Co.

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  American Hoist & Derrick Co.
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  Brown Hoisting Machinery Co.
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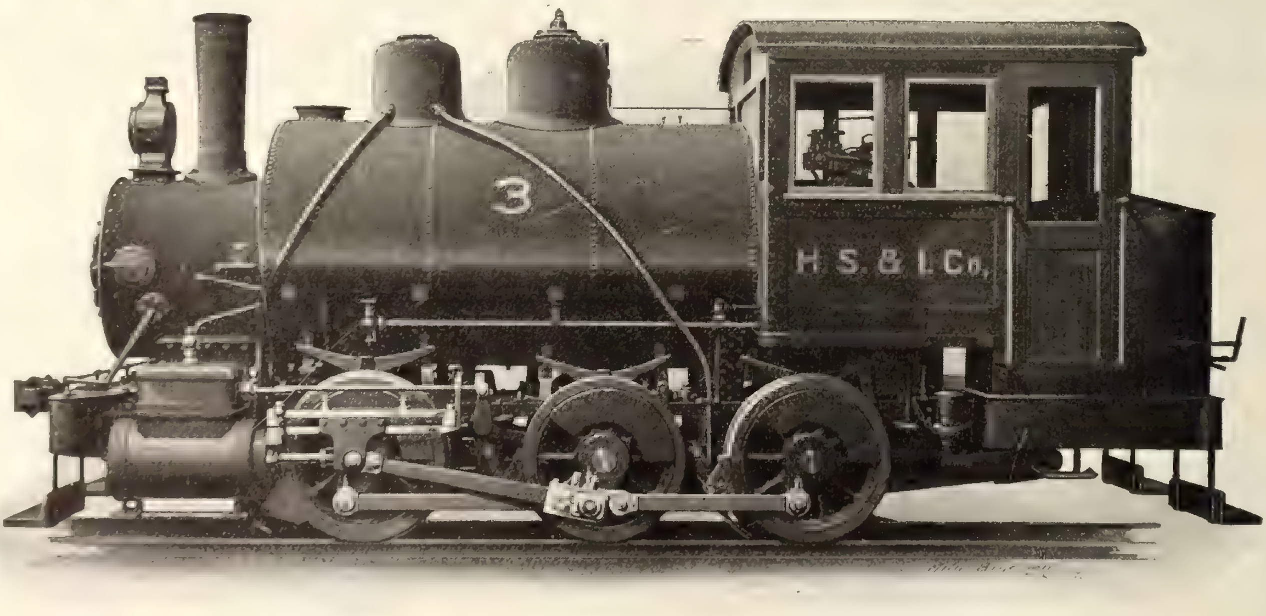
  Excelsior Plate Glass Co.
  Pilkington Bros.

(Continued on page 18)

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA
TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

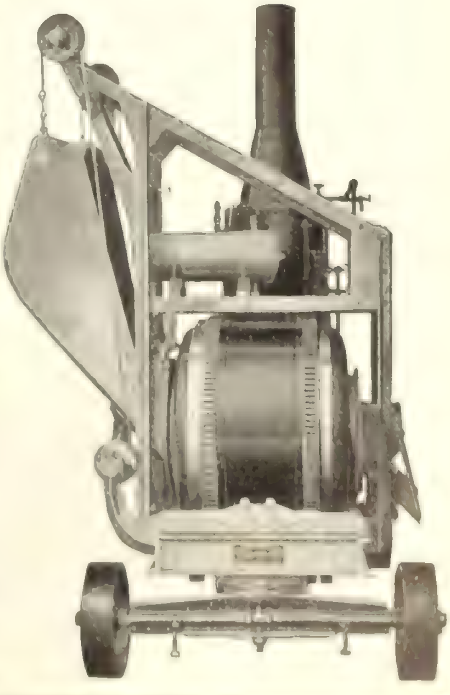
So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.

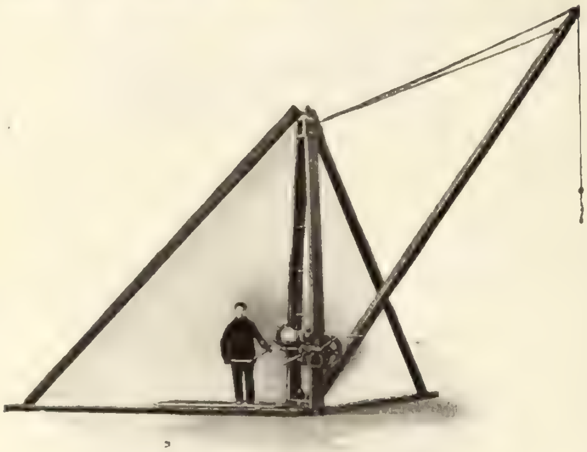
KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa



Beath Scotch Derricks



to 6 ton sizes in stock

Hand or Power

THE construction of Beath Scotch Derricks embodies several points of merit not found in other makes.

All stress parts are **steel** not cast iron. Bottom Pintle Bearing is of ball and socket type and works in a bath of oil, thus ensuring an easy movement at this joint.

Beath Derricks are provided with self-oiling bearings, ensuring easy operation and reducing wear to a minimum.

We also make Jinniwink Derricks, Stiff Leg Derricks, Guy Derricks, and Steel Derricks for heavy service. Hand or Power operated

Send us your enquiries for Derricks

Beath

Overhead Track Systems
Flat Rail Tracks and Trolleys
I Beam Tracks and Trolleys

The most efficient means known for handling goods in and about warehouse and factory, stone yard and quarry—in fact wherever goods have to be hoisted and moved.

Some Users of Beath Products

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Canadian Fairbanks-Morse Co., Toronto
Canada Foundry Co., Toronto
Dominion Radiator Co., Toronto
Steel Co. of Canada, Belleville, Ont.
Can. Crocker-Wheeler Co., St. Catharines, Ont.
Dunlop Tire & Rubber Mfg. Co., Toronto
Roman Stone Company, Toronto
BattlecreekToasted Corn Flake Co., London, Ont.
Massey-Harris Co., Toronto
Firstbrook Bros. Ltd., Toronto
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W. D. Beath & Son, Limited

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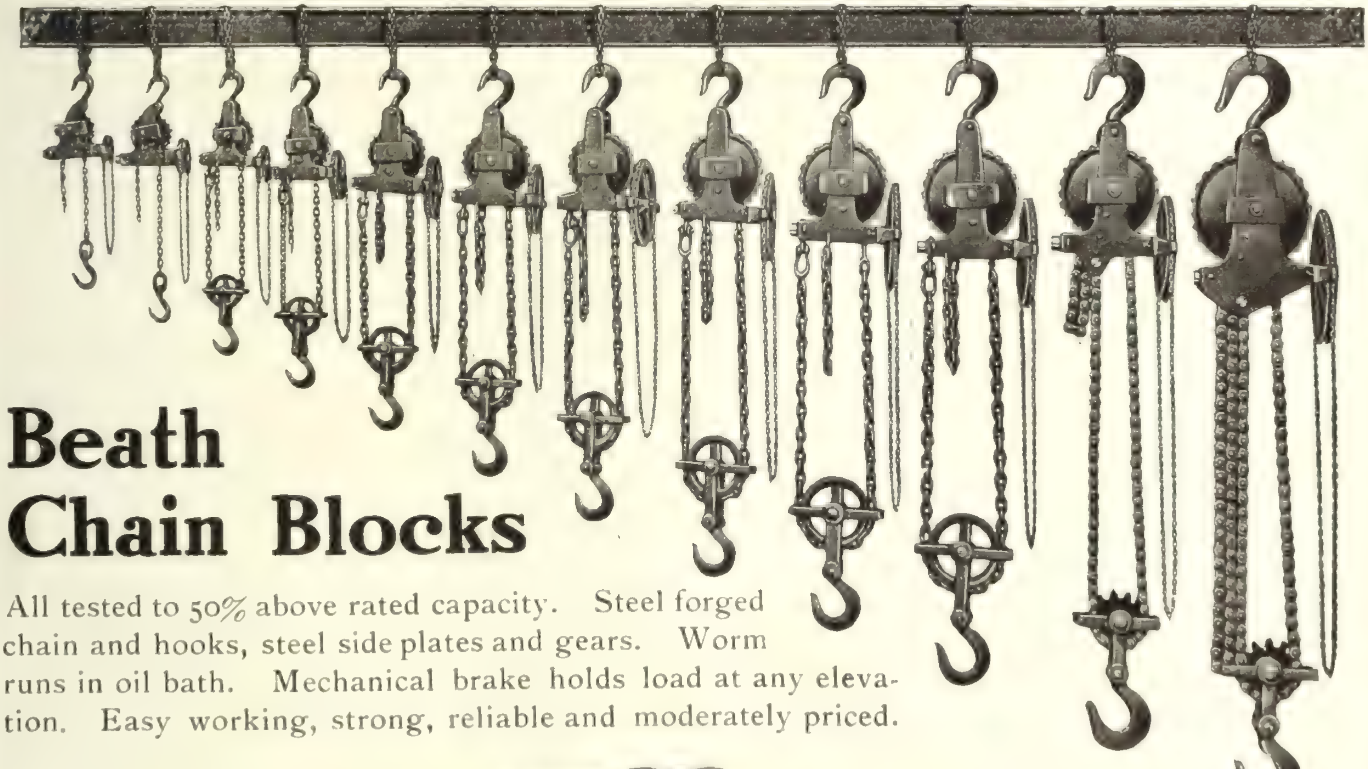
BEATH HOISTING MACHINES



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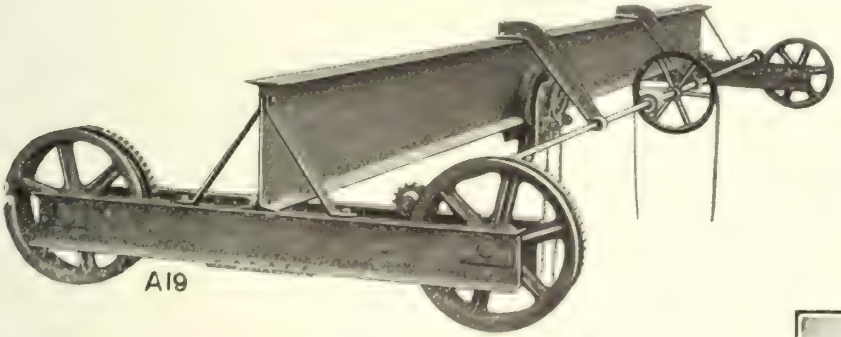
All tested to 50% above rated capacity. Steel forged chain and hooks, steel side plates and gears. Worm runs in oil bath. Mechanical brake holds load at any elevation. Easy working, strong, reliable and moderately priced.



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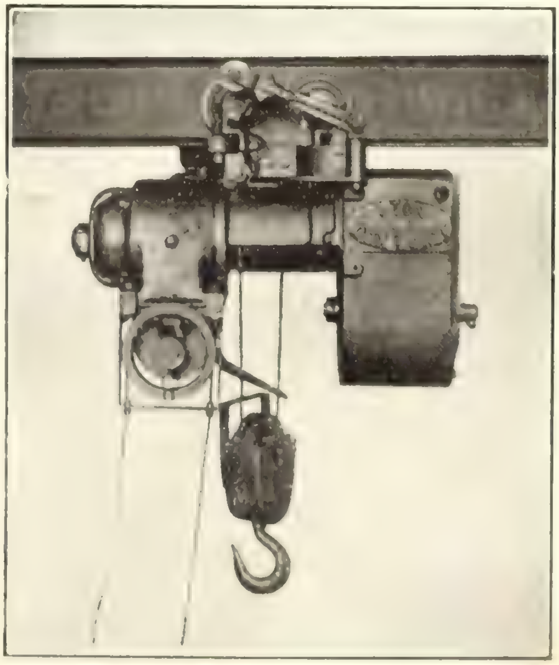
For rapid, easy hoisting and traveling Beath Box Electric Hoists give highly satisfactory service. Equally suitable as Portable Hoists, Crane and Runway Hoists and Travellers. Built for any capacity up to ten tons.



Beath Hand Power and Electric Cranes

We build a wide range of Hand Power and Electric Cranes suitable for any service.

Above Crane of 7½ tons capacity 30 span supplied the Edmonton waterworks two years ago. We have a large number of these and other types of cranes in satisfactory service all over Canada. Let us estimate on your hoisting and conveying requirements.

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- Canadian Fairbanks-Morse Co.
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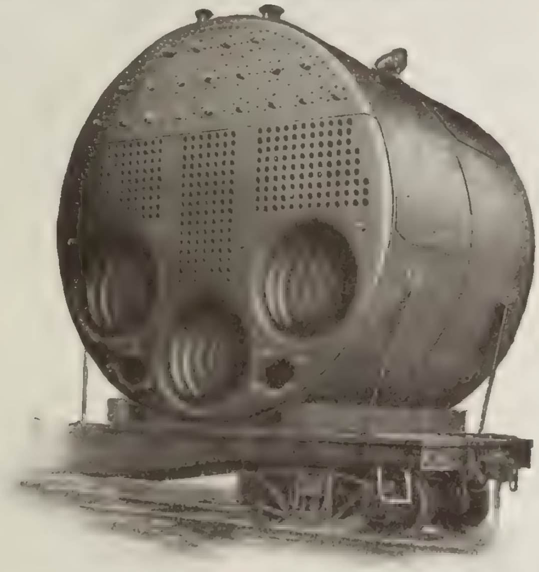

Marine Boiler built for R. & O. Nav. Co., Str. "Rapids Prince"

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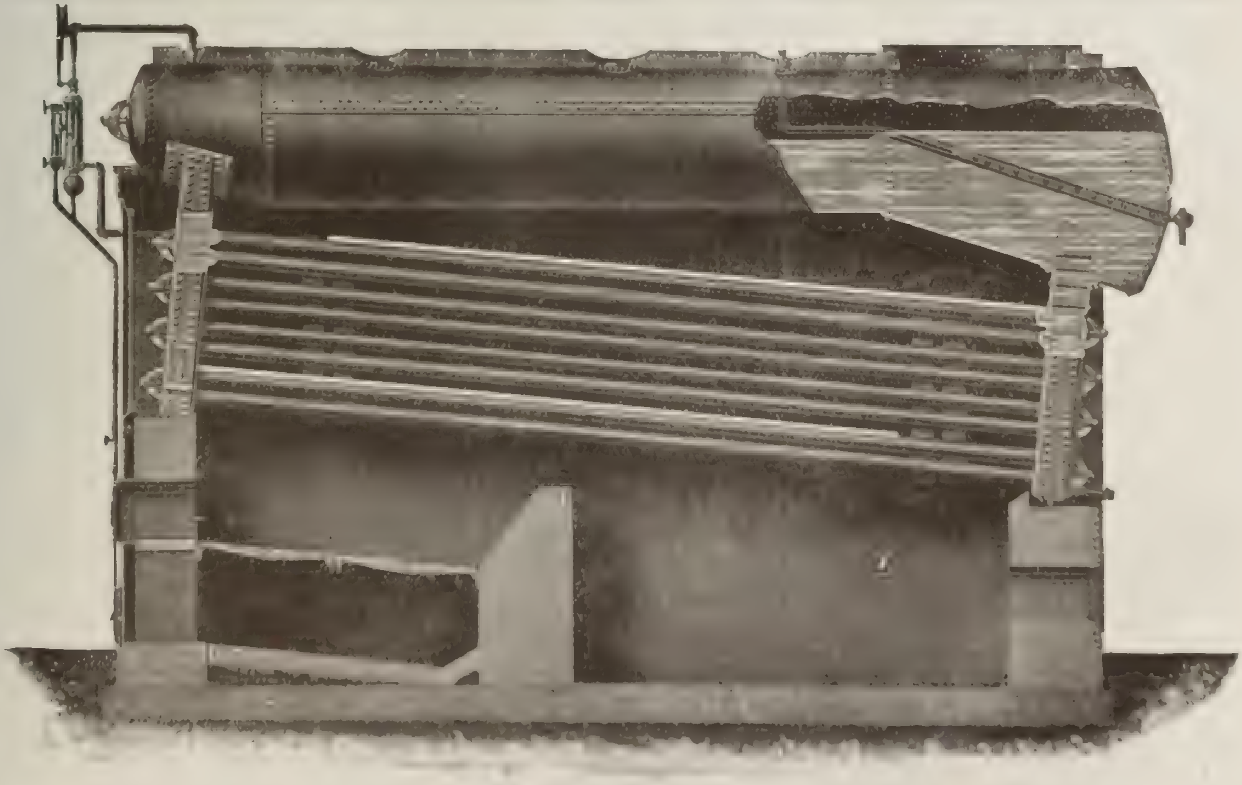
We are sole Canadian manufacturers of the well known "Erie City" Water Tube Boilers, vertical and horizontal.

Ask us for list of installations.



Erie City Water Tube Boiler

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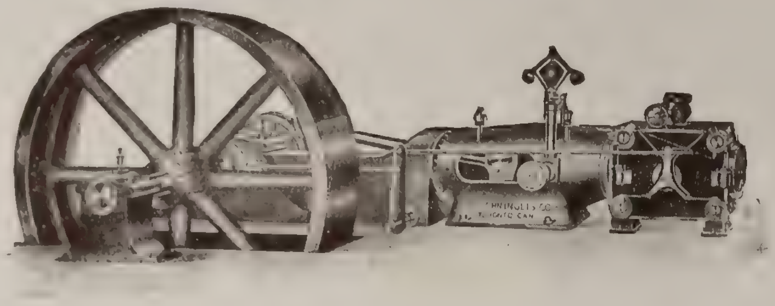
Engineers and Boilermakers



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Power Engines

Single, Compound and Triple Corliss Engines for Light and Heavy Duty. Slide Valve Engines, Rocking Valve Engines.

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Geared Pumps
High Duty Pumping Engines
Direct Acting Pumps
Centrifugal Pumps
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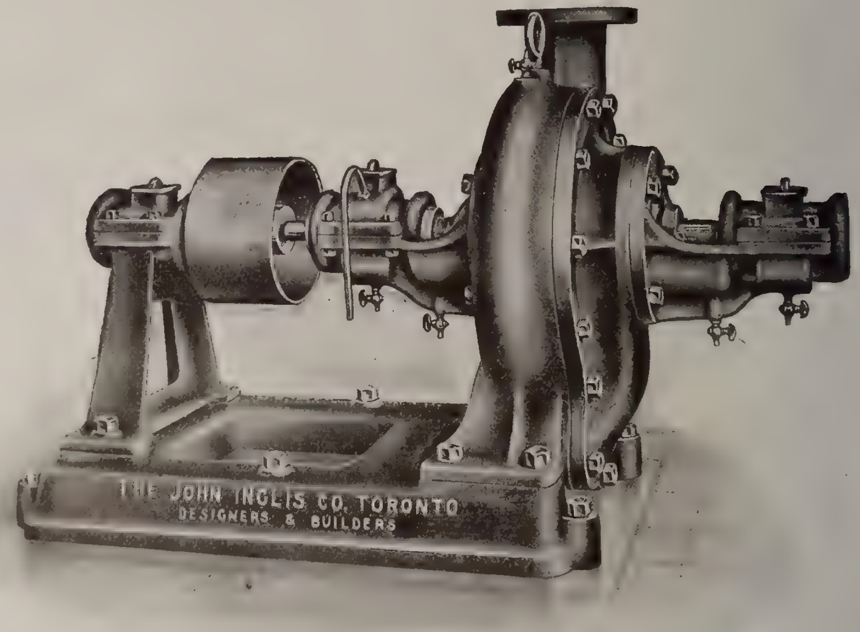
for any service.



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of all Kinds

"Inglis Standard" Return Tubular Boiler

Penstocks, Stand Pipes, Blast Furnaces, Flumes, Dryers, Smoke Stacks, Feed Water Heaters, Fertilizers, Hydraulic Machinery, Air Pumps, Hydraulic Presses, Special Machinery, Vacuum Pumps and Vacuum Pans.

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Penstock Distributor Built for the Ontario Power Co., Niagara Falls

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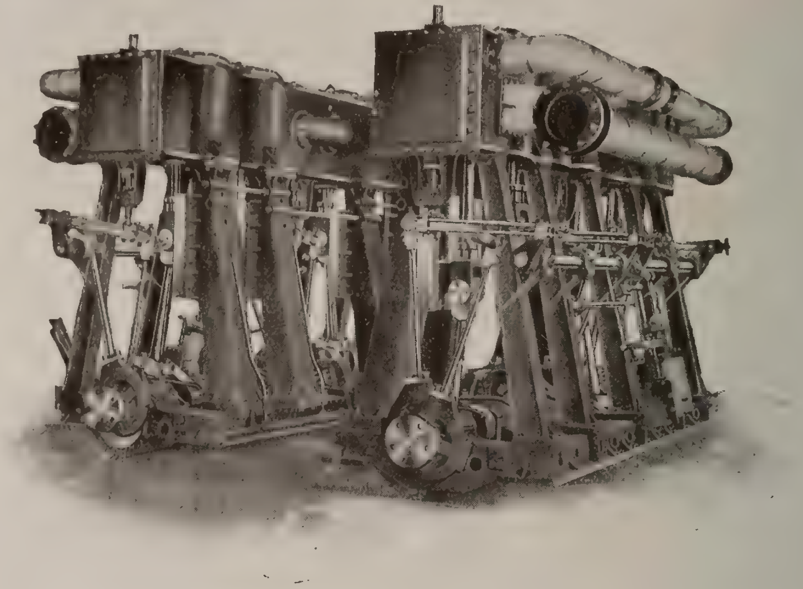
Triple Expansion
Single Compound
Steeple Compound
Quadruple
Incline
Tug Engines

Saw Mill and Mining Machinery



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First class workmanship, the best materials and the most modern design goes into every "Inglis" product before the name goes on.

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The PROTECTION & DECORATION of CEMENT CONSTRUCTION
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You Will Need It

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IT tells you how to protect such construction against moisture and shows you the wide range of construction on which it has been successfully used. It's really a picture book of the best concrete construction all over the country.

Send for it to-day. It will help you to make your construction more permanent and your architecture more beautiful.

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Canadian Architects, Eng[illegible]tractors and Master Builders recognize ***Bay State Brick and Cement Coating*** as the Standard Coating for the Protection and Decoration of Concrete and Stucco Surfaces.

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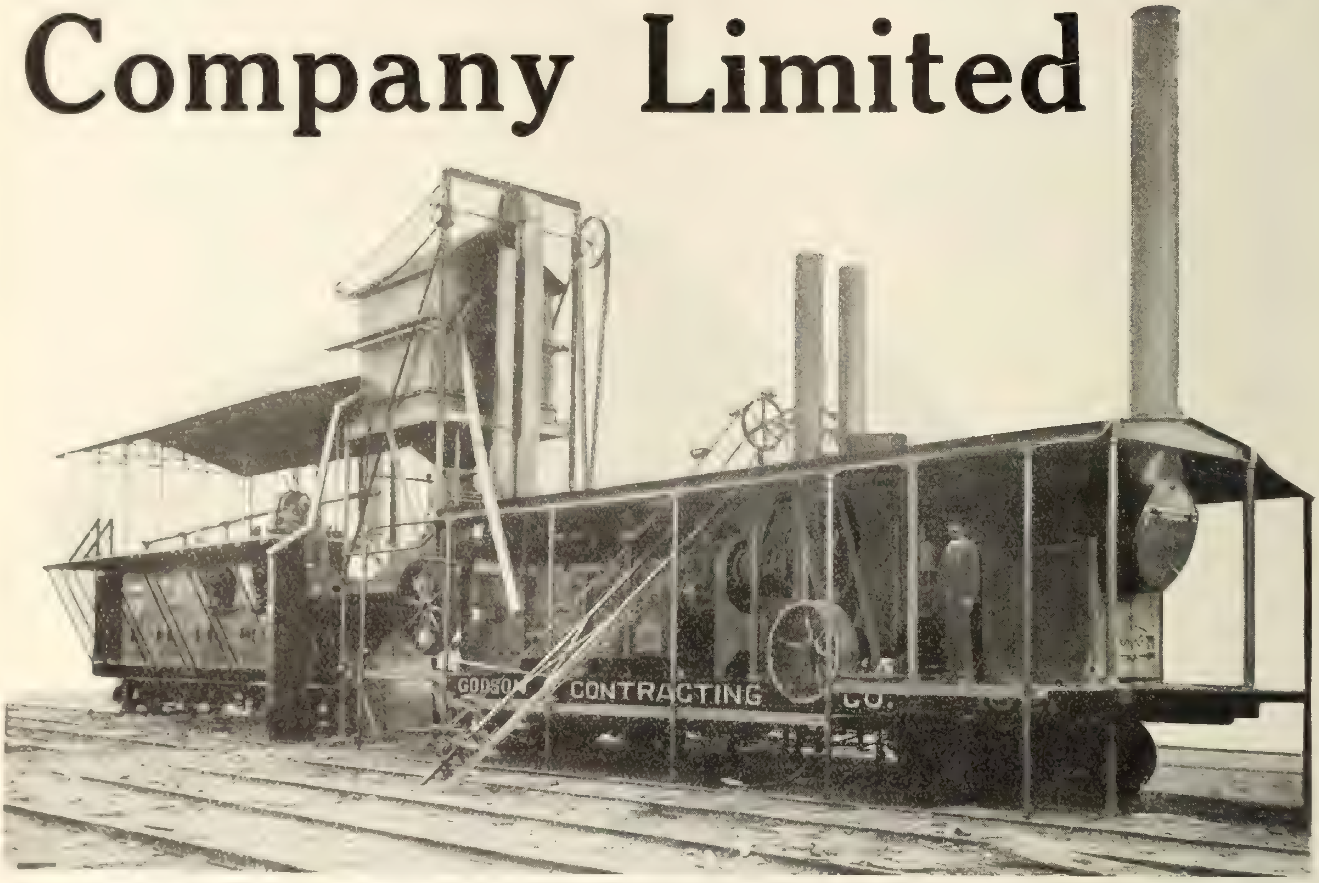

Two Car Portable Railway Asphalt Plant

With the above Plant, which is the most complete and up-to-date in Canada, we are thoroughly equipped to lay first class Asphalt and Asphalt Macadam Pavements in any City, Town or Municipality which appreciates the benefits of good Roadways.

We have been in the Paving Business for over forty years—our advice based on knowledge from such long experience is yours for the asking—write us.

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Godson Contracting Company, Limited

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¶ We have in course of erection and under contract in Canada the construction of the Methodist Book Room, Toronto, which is to cost $1,000,000, and also the new Royal Connaught Hotel, Hamilton, which is to cost upwards of $1,000,000.

¶ We shall be pleased to submit estimates for any large buildings anywhere in Canada.

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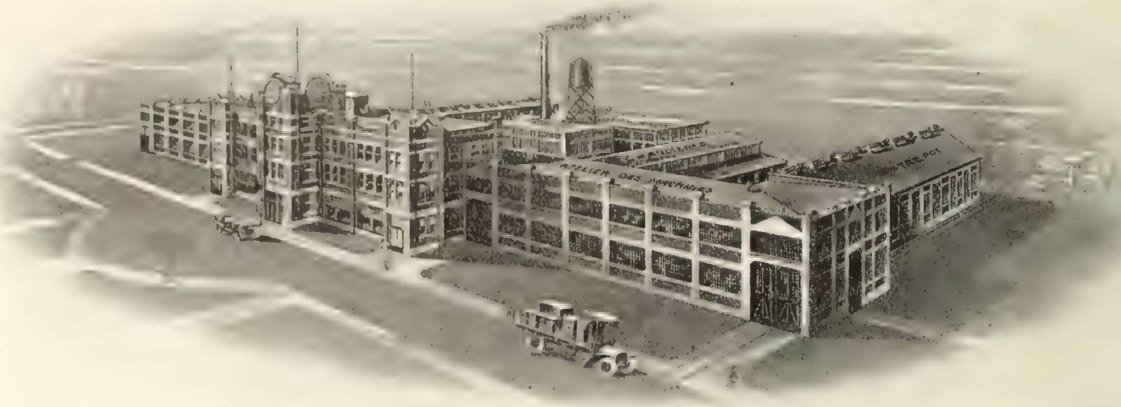
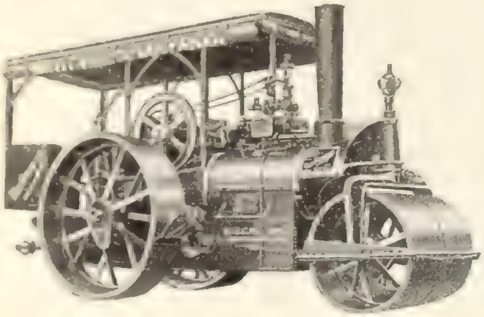
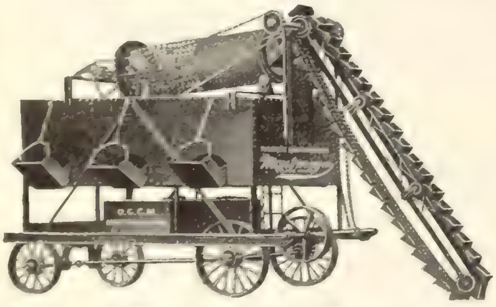
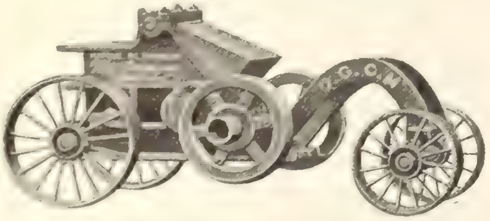




"Montmagny" Steam Road Roller.



"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny" Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

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Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"

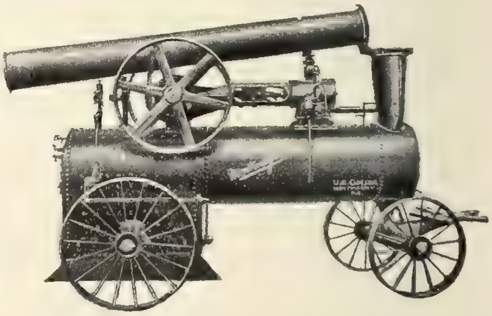
The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

For crushing field stone, granite, etc., "Montmagny" jaws are made of **manganese stel.** They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.

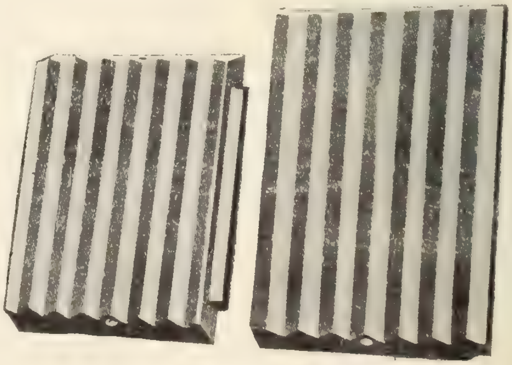
"Montmagny" Road Sprinkler.

The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.



"Montmagny" Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.



"Montmagny" Manganese Steel Jaw Plates.

See the Large Exhibit of our Machines at the First Canadian Good Roads Congress

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CANADA for CANADIANS

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Specializing in

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MANUFACTURING THE WHOLE OUTFIT

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You want to build Good Roads? The Best?

We Always Have

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Hundreds of our machines in use throughout the province of Quebec. Highest testimonials in favor of our machines prove their merit.

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The most beautiful stone for interior decoration

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Quotations promptly given from architects' designs.

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Sewer Pipe

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Plaster Paris, Weeping Tile
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WELL DRILLS are *not* BLAST-HOLE DRILLS

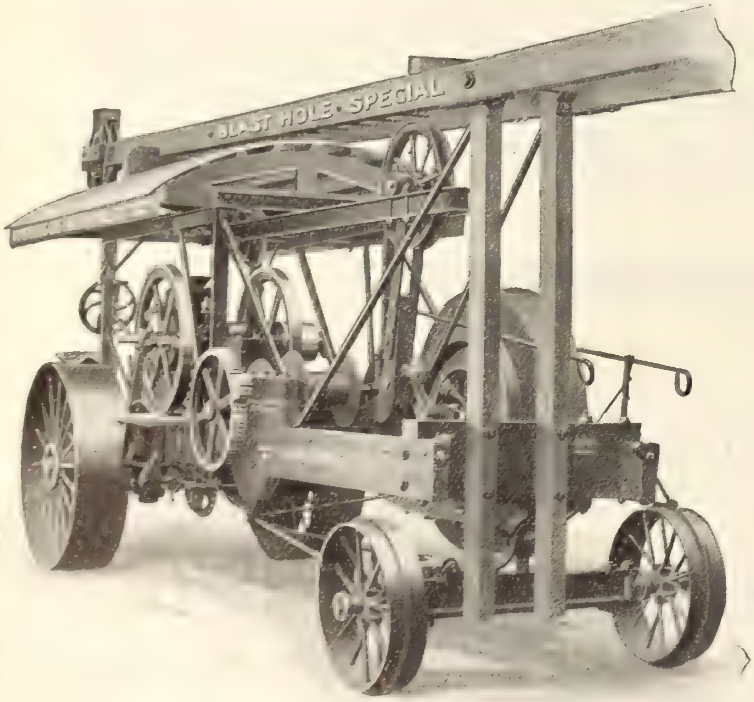
This is an age of specialization—Contractors and Quarry Operators who use Armstrong Special Blast-Hole Drills do so because the "Armstrong Special" is designed exclusively for drilling BLAST HOLES—NOT WELLS.

"Armstrong Special" Blast-Hole Drills are not well drills. We build well drills and have been since 1867, but we know, as do scores of successful contractors and quarry men, that well drills are not designed for and will not stand the grief of blast-hole drilling (a comparison of machines which have been in operation for a reasonable period of time will convince you). Behind our knowledge is fifty years of drill building experience—behind the experience of users is the knowledge that ARMSTRONG machines are not only more efficient, but the repair, operating and "upkeep" expense is much less, due to the fact that

The Armstrong Special Blast-Hole Drill is the only Cable Blast-Hole Drill designed exclusively for Blast-Hole Drilling

That is why it accomplishes more for the Contractor and Quarryman than any machine of any other type

Every working part of the "ARMSTRONG" Special Blast-Hole Drill is designed with direct reference to hard rock drilling. The "ARMSTRONG" spudding beam —the most important feature—gives a quick, sharp, springy blow that drills more holes at less cost than any other. The "ARMSTRONG" raises the tools as fast as they drop and *does not allow the tools to rest at the bottom of the hole* as in the case of well drills.



If we can prove to you that the "ARMSTRONG" will drill blast holes cheaper and better than any other machine, you surely want to know it. All you have to do is send a postal asking for proof of "ARMSTRONG" Special Blast-Hole Drill superiority, and address today to

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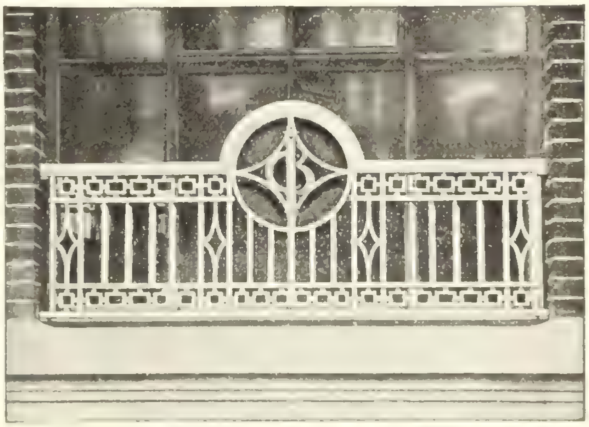
MFG. CO. WATERLOO, IOWA, U.S.A.
BUILT FOR SERVICE
SINCE 1867

EFFICIENT ASSISTANCE AT YOUR COMMAND

Two heads are better than one. No matter how thorough you may be—no matter how extensive your construction knowledge—there are many little details about ornamental metal work in which we can render you valuable assistance.



An artistic and yet economical treatment of ornamental work in Iron and Bronze requires an intimate knowledge of the manufacturing methods by which such work is produced. Such knowledge is ours by right of long experience, and we take this opportunity to extend to you the services of our designing department in execution of your Spring work.

Full information gladly furnished as to sizes and weights of materials, with preliminary sketches, designs, and full sized details of ornamental work, if desired. Particular attention will be given to the careful execution of your drawings, endeavoring to carry out the work in the spirit, as well as to the letter, of the design.

A large, modern factory, devoted exclusively to the production of Ornamental Iron, Bronze and Wire Work, and equipped with every facility for the manufacture of work of the best grade, and a well-organized staff of skilled designers and craftsmen, enables us to promptly execute any work entrusted to us, no matter how large or small the contract may be. Shipments are made in the shortest possible time after receipt of the order, to any part of the country.

We issue a large "Catalogue of Architectural Details," containing many photographs of our work, with sketches and working drawings of our various designs and details.

Metal Wickets, Railings
Grilles, Guards and Screens
Steel Window Sash
Marquises, Balconies
Church Metal Work
Elevator Enclosures
Steel Lockers and Shelving

Fire Escapes, Crestings
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Complete Jail Cells
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Bronze Tablets

The Dennis Wire & Iron Works Co. Limited
General Office and Works:
LONDON, ONT.

For Strength
and Durability

Bull Dog Shovels

Have No Equal

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Square and
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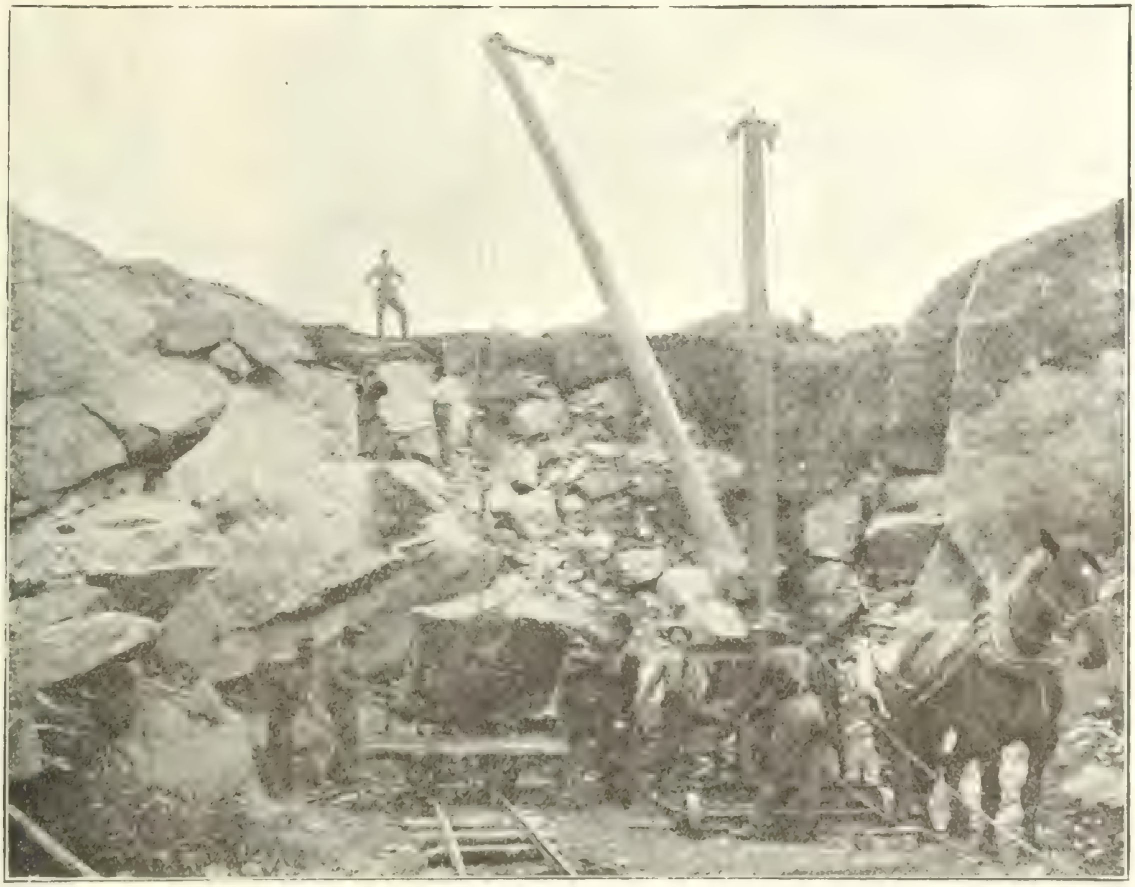
The Canadian Shovel & Tool Co., Limited
Hamilton - Canada

THE FOREST LOADER



The Forest Loader was originally designed for logging operations, but has been adopted by many prominent contractors to the exclusion of other derricks.

FOR RAILROAD CONTRACTORS

The illustration shows a Forest Loader in use on the C. N. R. at [illegible], Ont. This machine loaded 122 2½-yd. cars of rock in ten hours with five men and one horse. Foley Bros., the contractors, now have nine loaders working on their C. N. R. rock work. The Dominion Construction Company, contractors for the C. P. R., after doubling their daily output with a Forest Loader, have since placed six more machines at work.

FOR GRAVEL AND SAND PITS

The Forest Loader can be used to excellent advantage in sand or gravel pits. With its boom swinging a full half circle and covering a distance of 36 feet, a larger swath can be covered at one setting than with a steam shovel, necessitating fewer changings of tracks.

FOR STONE YARDS AND QUARRIES

The lifting capacity of the Forest Loader renders it specially adaptable for use in quarries, where it can handle with ease stone weighing up to 10,000 lbs. Furthermore, it can be moved out of the blasting zone in a minimum of time, and set up again wherever desired.

The value of the Forest Loader as a lifting device lies in its tremendous strength, the ease and dispatch with which it can be moved and set up, its simplicity of construction and its economy of operation. Complete machine weighs 3,000 lbs.

We solicit enquiries from Contractors and builders

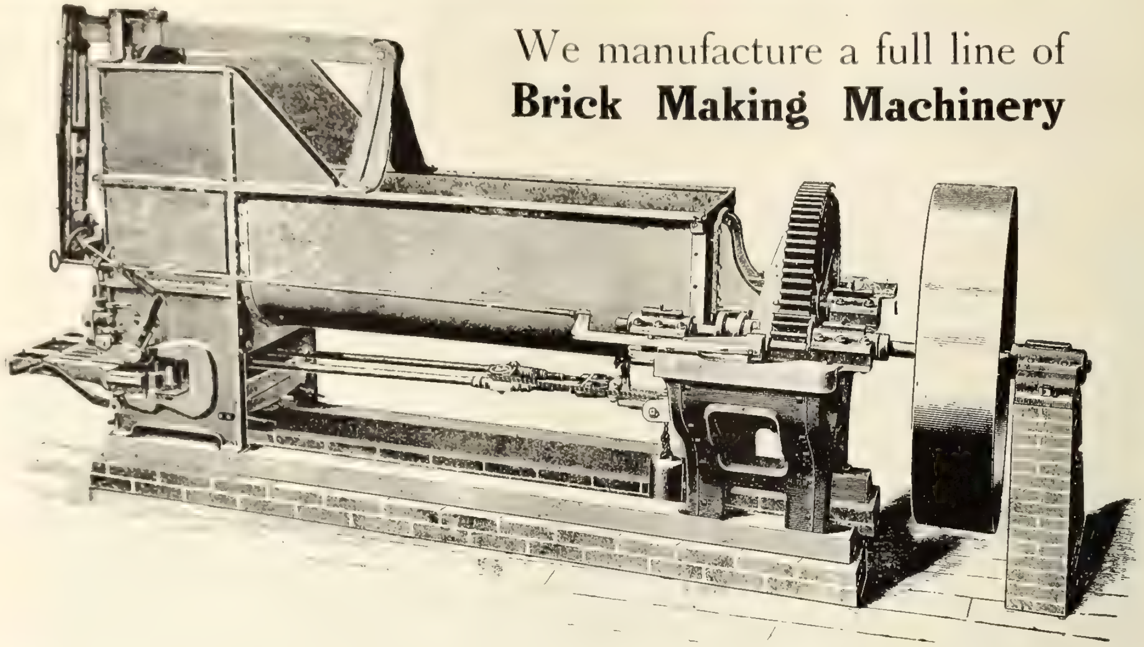
WOODSIDE BROS., PORT ARTHUR, ONTARIO

AGENCIES :

Messrs McDougalls Limited, Ottawa, Ont.

Dominion Equipment & Supply Co., Winnipeg, Man.

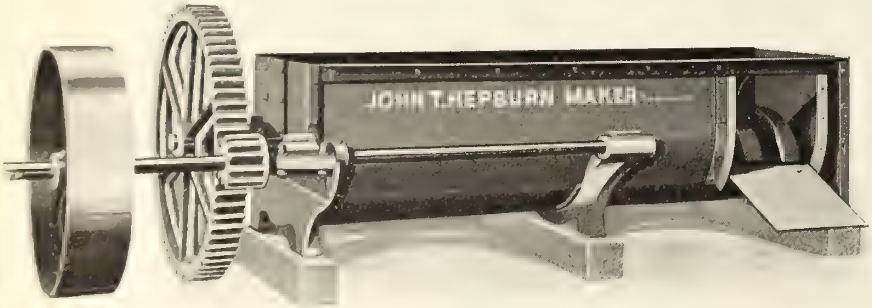
We manufacture a full line of
Brick Making Machinery



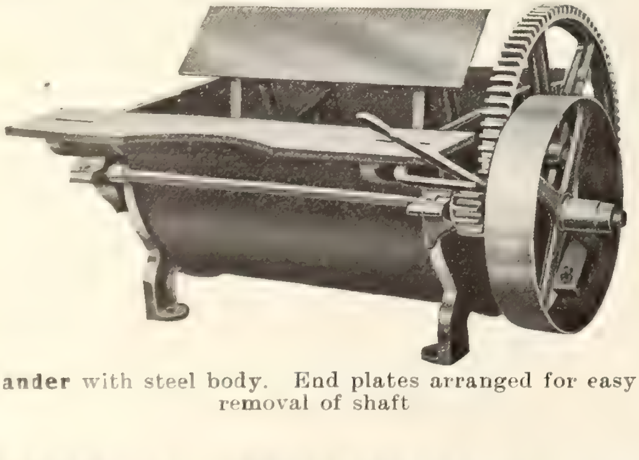
Hercules Brick Machine kept in stock—ready for prompt delivery

BRICK MACHINERY

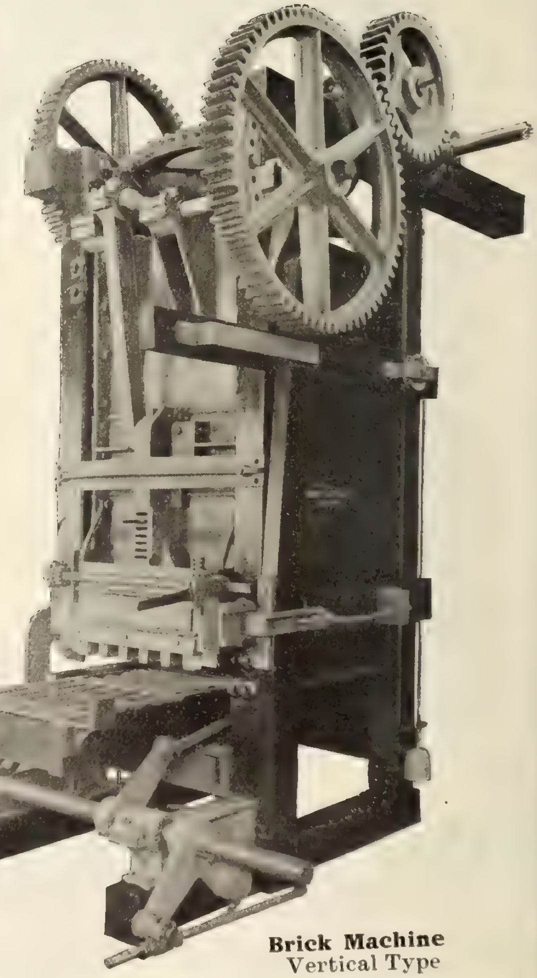
IRON CASTINGS
of all descriptions up
to Ten Tons.



Pug Mill with steel body. End plates arranged for easy removal of shaft



Sander with steel body. End plates arranged for easy removal of shaft



Brick Machine
Vertical Type

JOHN T. HEPBURN, Ltd.

Iron Founders, Crane Makers and Machinists
18-40 Van Horne Street, TORONTO

All Types of CRANES

for

Stone Yards, Machine Shops, Builders and Contractors, Quarries

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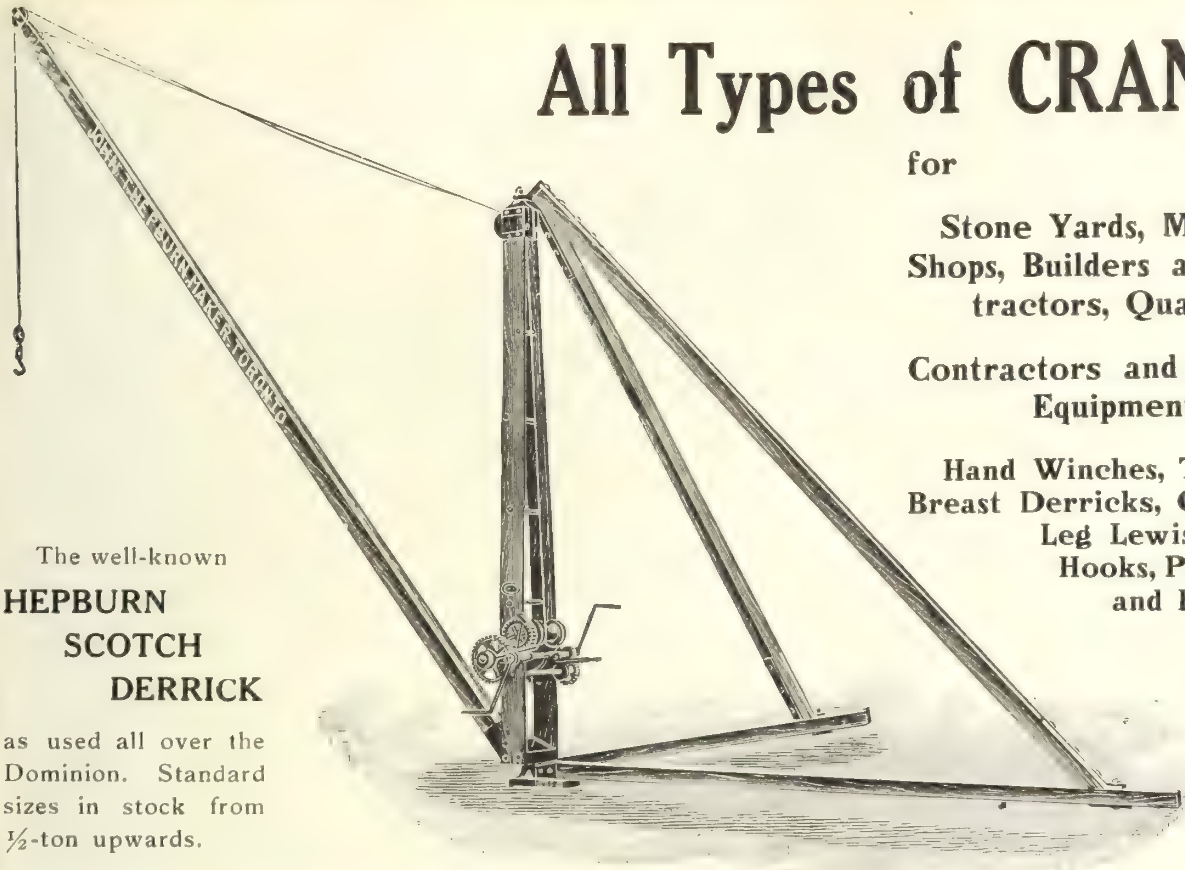

JOHN T. HEPBURN MAKER TORONTO

The well-known

HEPBURN SCOTCH DERRICK

as used all over the Dominion. Standard sizes in stock from ½-ton upwards.

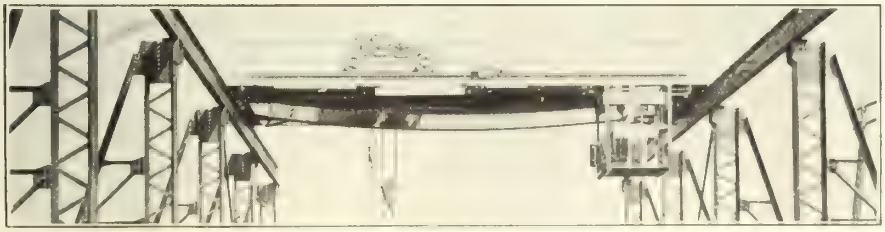


Illustration of **Standard Electric Overhead Traveller.** Capacity 20 tons. Girders Box Plate Type

Electric Derricks
Electric Winches
Electric Capstans

Illustration of a **Standard Electric Overhead Traveller.** Capacity [illegible] tons. Girders Warren Braced Type.

Illustration of **Electric Derrick.** [illegible] capacity. Boom [illegible] Steel Boom and Steel Mast

JOHN T. HEPBURN, LTD., *Iron Founders, Crane Makers and Machinists*

18-40 Van Horne Street, TORONTO

BRICK-The Permanent Pavement
LAYING THE BRICK
U.S. Government Model Brick Road
Chevy Chase, Md.

GOV. GLYNN in His Message to the New York Legislature:

"New York is engaged in building 12,000 miles of road, which will wear out forty years before they are paid for.

"Unless the state makes a radical change in the type of road it builds, it will cost from $20,000,000 to $30,000,000 yearly to maintain and rebuild New York's highways when the present system is completed."

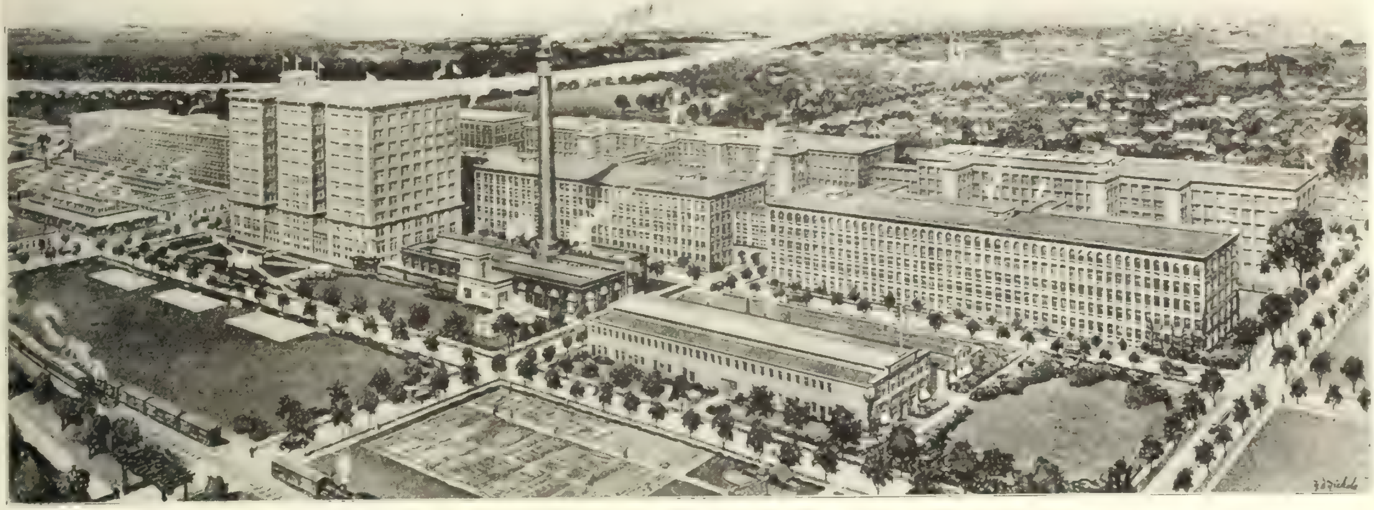
"BRICK ROADS have been laid in hundreds of cities and have everywhere demonstrated their durability. BRICK ROADS have been down for twenty-five years and have admirably withstood the test of the hardest kind of traffic."

We have technical and popular publications which deal with every feature of proper brick pavement construction. A request will bring them.

National Paving Brick Manufacturers Association

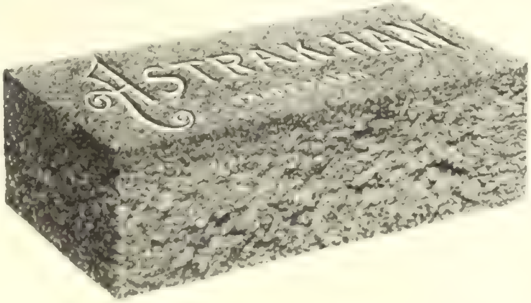
Will P. Blair, Secretary

Cleveland, Ohio



Office and Factory Building of
THE NATIONAL CASH REGISTER COMPANY, DAYTON, OHIO
2,500,000 Buff and Gray Brick, manufactured by The Columbus Brick and Terra Cotta Company, Columbus, Ohio, were used in the facades of these buildings.

Our Astrakhan Brick is the most perfect, rough texture brick on the market in size, shape and quality.



Made in BUFF, ONYX, GRANITE, GRAY and FLEMISH

DRY PRESSED Gray, Buff Speckled, Gray Speckled Standards and Normans

WIRE CUT . . Ivory and Gray in Standards only

ORNAMENTAL In all colors

BRICK MANTELS AND ARCHES MADE TO ORDER

The Columbus Brick & Terra Cotta Co.

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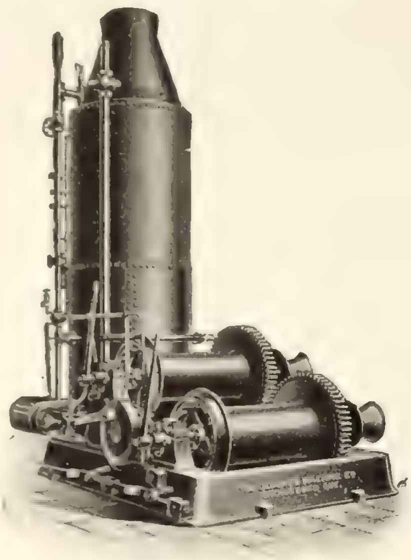
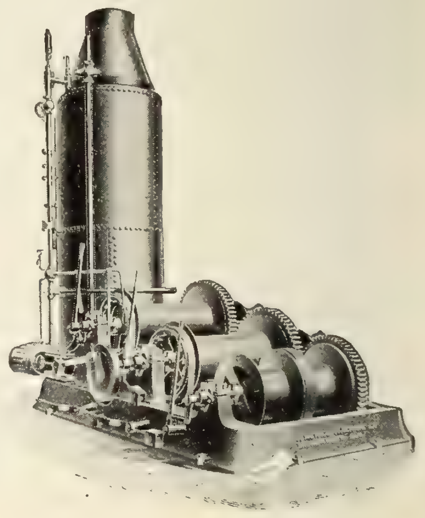
Jenckes Equipment

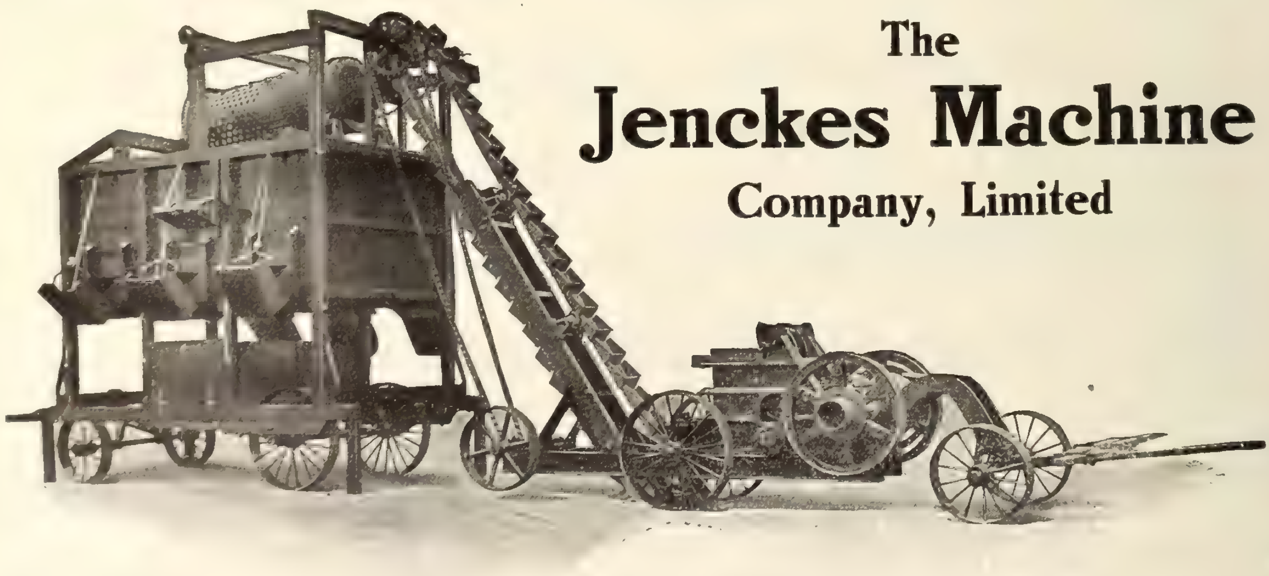


WE make hoisting engines and boilers of every size and type suited to the needs of contractors. Our wide experience in the making of contractors' equipment has enabled us to produce a hoist that is hard to beat.

We illustrate our complete rock crushing, elevating and sorting outfit, the equipment that can "follow the job."

Any of our offices will be glad to supply you with catalogues and prices. Write us.





The
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Company, Limited

General Offices: Sherbrooke, Que. **Works: Sherbrooke, Que., St. Catharines, Ont.**

Sales Offices: –Sherbrooke, Montreal, St. Catharines, Cobalt, So. Porcupine, Vancouver, Nelson

ONLY PLANT IN CANADA

The Frontenac Floor & Wall Tile Co.

Limited

Kingston, Ont.

Ceramics absolutely non-absorbent.
Vitrified in all sizes and shapes.
Surface smooth and uniform, cleans easily.
Shipments prompt.

Works located at junction of main line C.P.R. and G.T., and in close proximity to water route through Great Lakes.

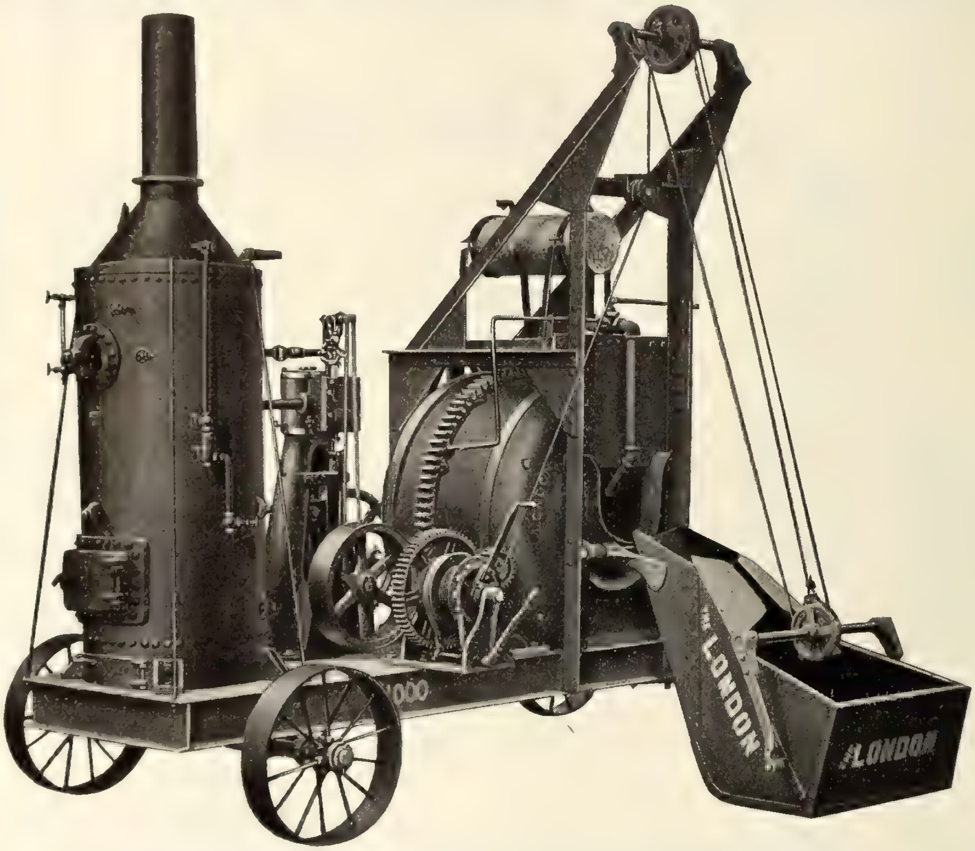
Prices consistent with quality—NO DUTY. Quotations and samples on request. All goods sold through tile contractors.

SELLING OFFICE:

911 New Birks Building Montreal

LONDON
Concrete Batch Mixers

are built entirely of steel. All parts very heavy



London Standard Drum Batch Mixer, with Steam Engine, Boiler and Power Loader

BUILT IN FIVE SIZES

Built to run 24 hours per day the year round

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London Concrete Machinery Co., Limited

Cabell St. and Kitchener Ave., LONDON, ONT.

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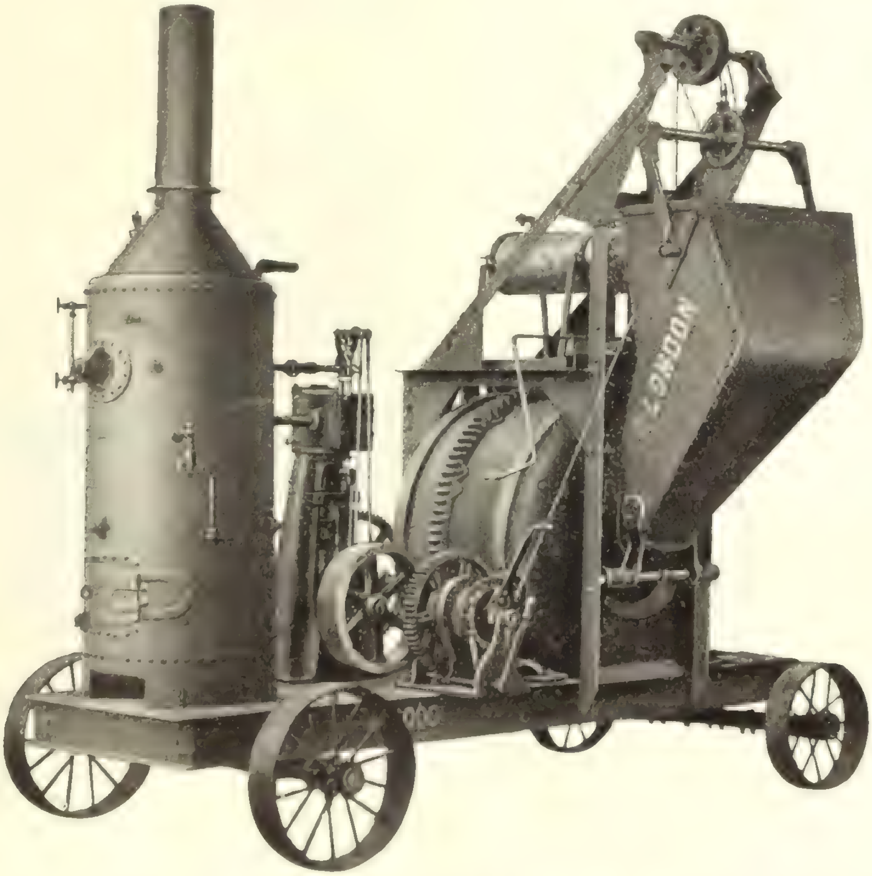
LONDON
Standard Drum Batch Mixer

Built in Five Sizes

Our power loader will discharge perfectly clean and will not spill any of the contents on the ground.



Our power loader is operated with Standard hoisting drum and cone clutch.
The skip raises in seven seconds.

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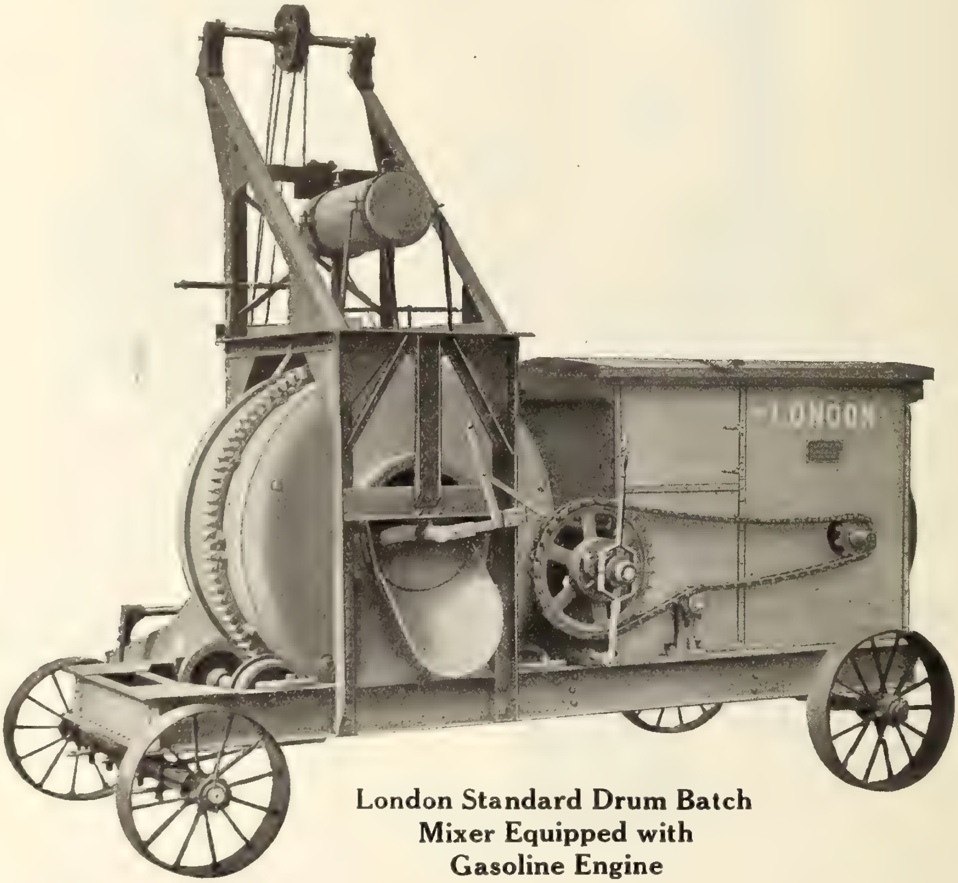
LONDON

Standard Drum Batch Mixers

Built in Five Sizes

Are furnished with any equipment and are made in five different sizes. All sizes are equipped with traction drive when ordered.



London Standard Drum Batch Mixer Equipped with Gasoline Engine

Note the construction of this mixer. All parts very heavy. Built on the most approved designs. Embodies only the highest grade of materials and workmanship.

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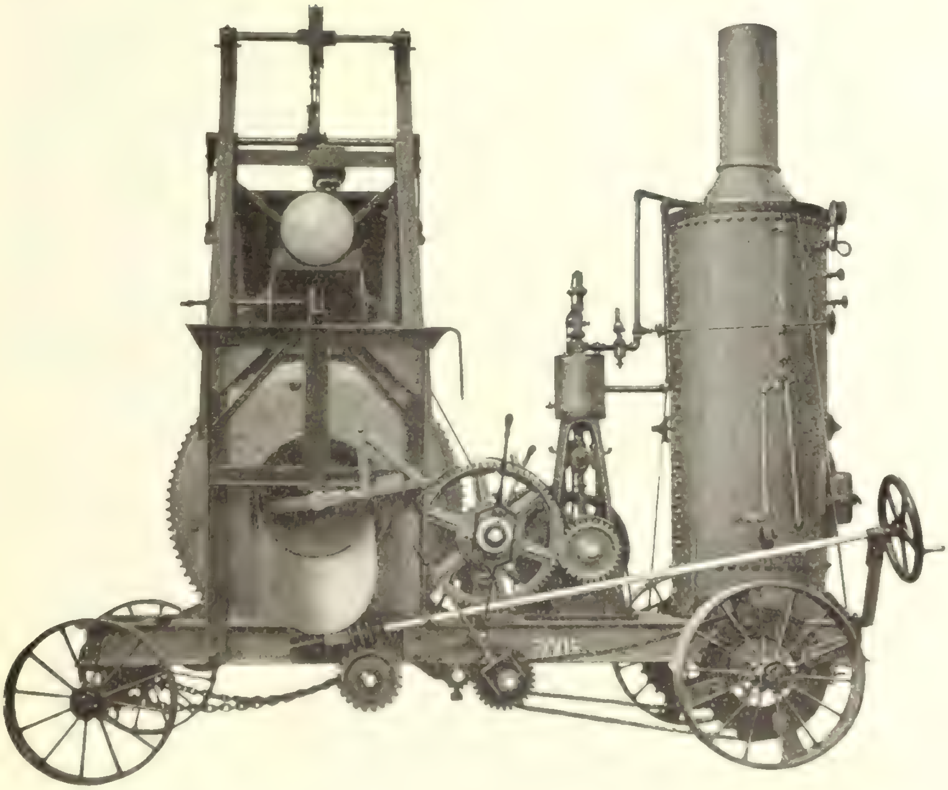
LONDON
Standard Drum Batch Mixer
with Forward and Reverse Traction Drive



The only machine of its type on the market. Built to last a lifetime.

Made in five sizes and equipped with any kind of power.

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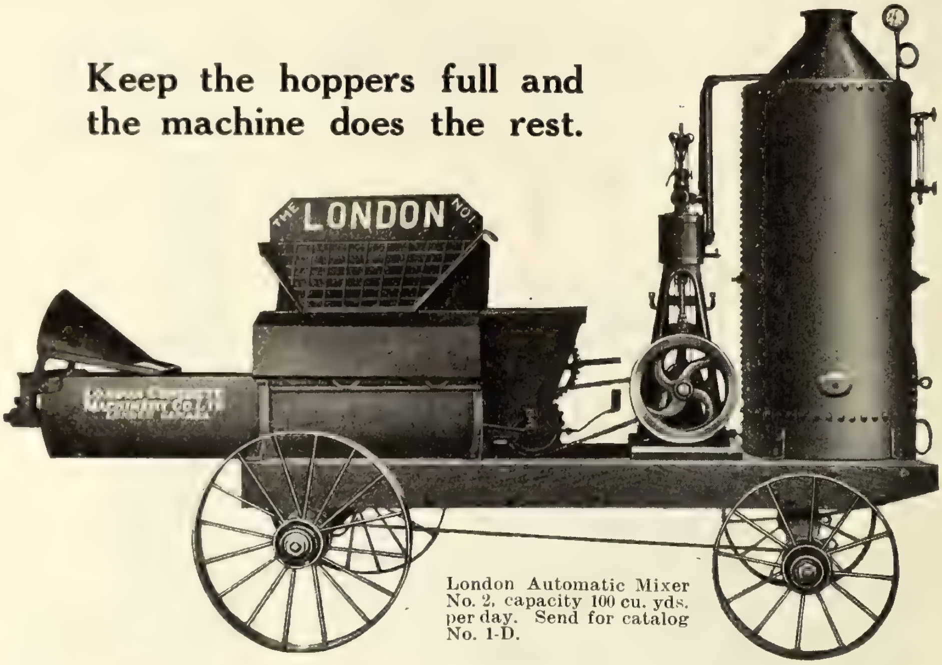
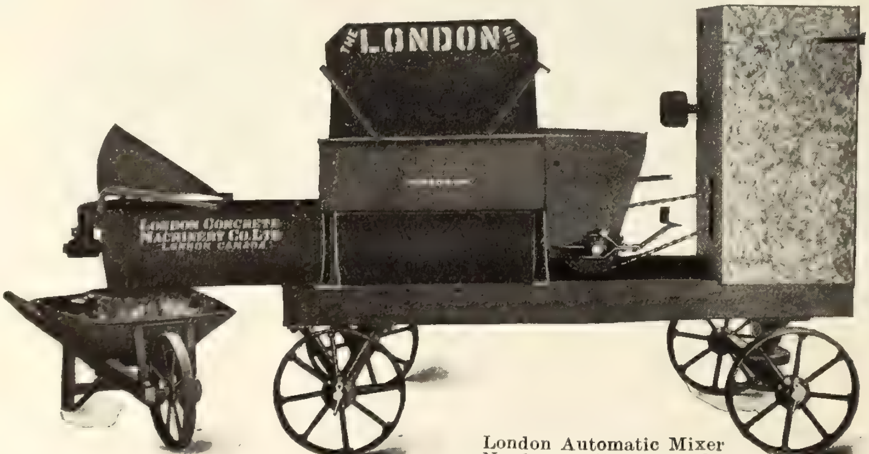
LONDON

Automatic Batch Concrete Mixer

Keep the hoppers full and the machine does the rest.



London Automatic Mixer No. 2, capacity 100 cu. yds. per day. Send for catalog No. 1-D.



London Automatic Mixer No. 1, capacity 50 cu. yds. per day. Send for catalog No. 1-C.

The London Automatic Batch Concrete Mixers are built in two sizes and with any equipment. These machines are in great demand for all classes of work when the machine requires to be moved often, as they are light. The price is moderate and they will do the work as well as any machine at any price.

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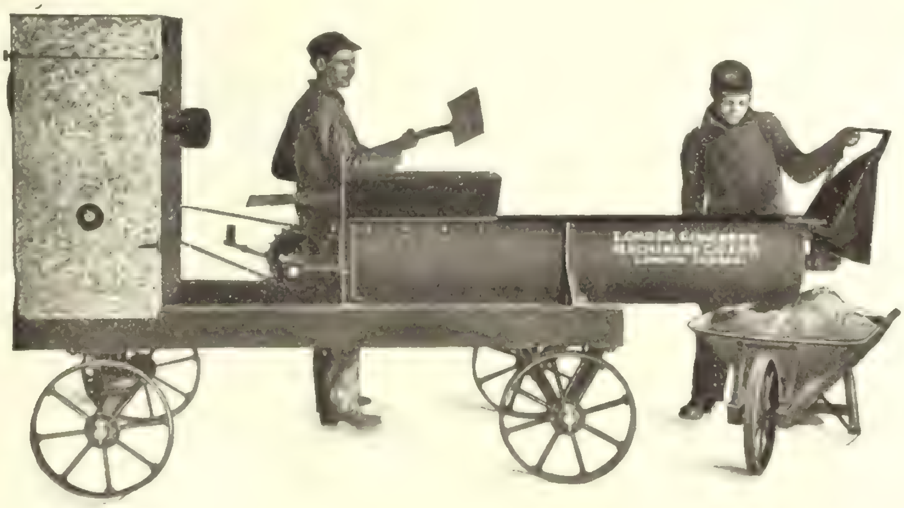
LONDON

Mortar Mixer

All Masons, Brick-Layers, Plasterers should use a mortar mixer. It will do better work than can be done by hand and do it 8 times as fast. Can be used as a batch or a continuous mixer.



This is just the machine that the man who mixes mortar has been looking for. Saves the price of itself in 30 days.

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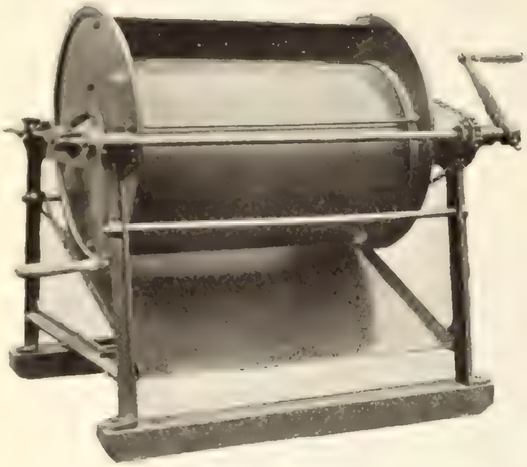
Little Giant Hand Mixer



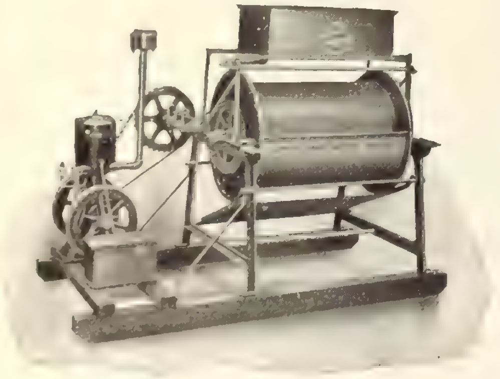
Little Giant Hand Mixer.

The only satisfactory hand mixer on the market.

Mixes 4 cubic feet at a batch. Capacity, 25 cubic yards per day.

The reason this mixer turns so easy is because the material during the mixing is raised at the centre of the drum and tossed to the outside.

Little Giant Hand Mixer ready to receive the material.



Little Giant Mixer with 1 1/2 H. P. Gasoline Engine.

It is the mechanism on the inside that does the business.

Can also be used as a power mixer.

Send for catalogue No.-1-G

London Concrete Machinery Co., Limited

Cable St. and Kitchener Ave., LONDON, ONT.

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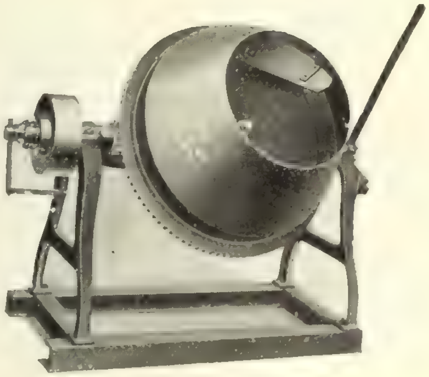
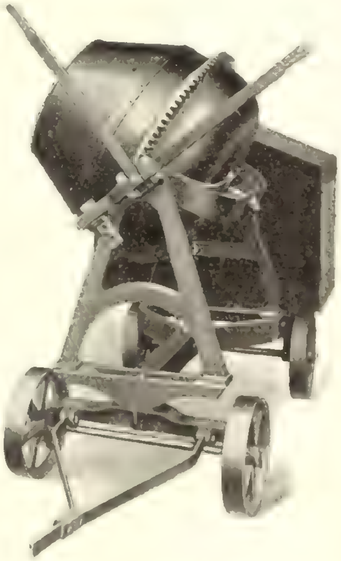
Gem Batch Mixer



Gem on skids

The Gem Batch Mixer is adaptable to any class of work, can be operated with one man, the concrete always in view.

Mixes 5 cubic feet at a Batch or 40 cubic yards per day. Just the machine for small jobs.



Gem on Trucks with power

This is a high grade Small Power Mixer at a Small Price.

Gem on skids with 2½ h.p. Gasoline Engine

WRITE FOR PRICES

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London Concrete Machinery Co., Limited

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Bull Dog Batch Mixer

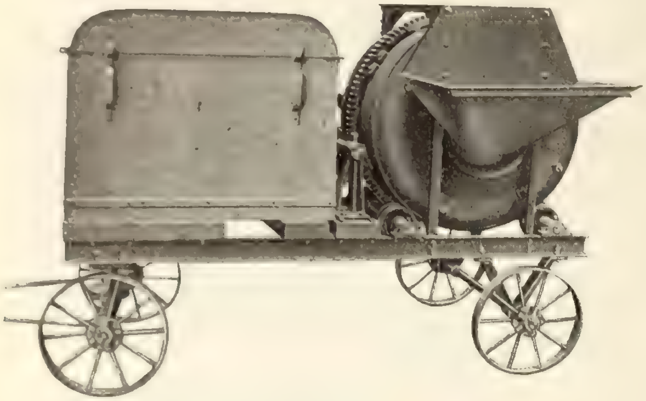

Fig. 130

The BIGGEST Little Batch Mixer on the market

Mixes 5 cubic feet at a Batch, or 50 cubic yards per day. This machine can also be furnished with a power loader and an extra hoisting drum.

Just the Machine for all small jobs.

A High Grade Mixer at a Small Price.

The Best Value in a Batch Mixer ever offered.

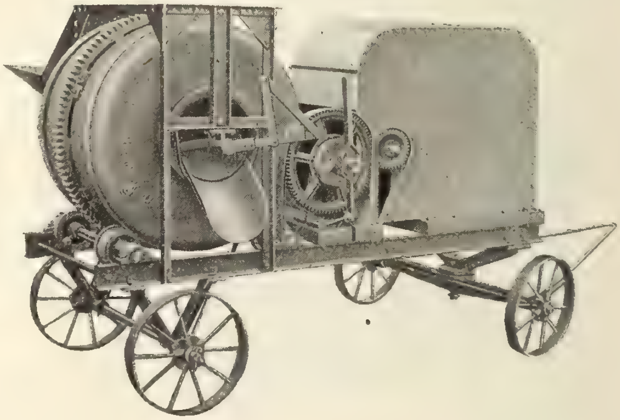

Fig. 131

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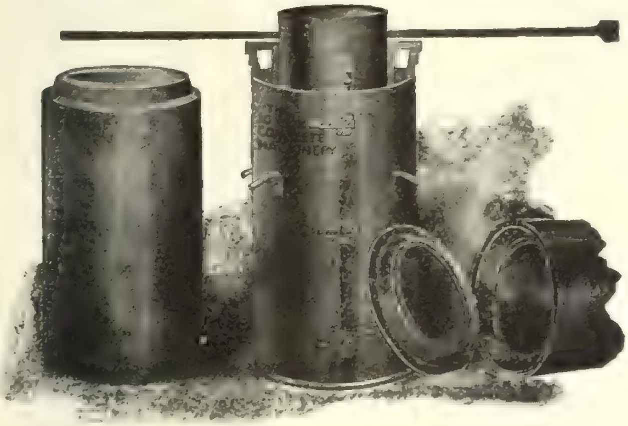
LONDON



Sewer Pipe and Culvert Moulds are built in all sizes and to meet any specifications

---

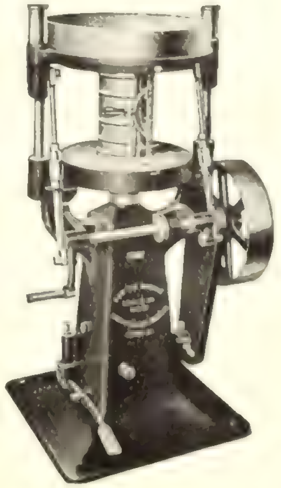
Steel Concrete Tile and Sewer Pipe Moulds.

Telescopic or plain jointed 4 inches to 48 inches in diameter.

All moulds are made from high carbon cold rolled steel, built very heavy and will stand the roughest usage.

Over 12,000 now in use. Send for catalogue No. 2-B.

The Dunn Cement Drain Tile Machine



makes all sizes of tile from three to twelve inches. The London tile machine which is a larger size makes all sizes of tile up to eighteen inches.

A catalogue on request. Send for catalogue No. 2

London Concrete Machinery Co., Limited

Cabell St. and Kitchener Ave., LONDON, ONT.

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HALIFAX—68 Upper Water Street—R. R. Power, Manager.

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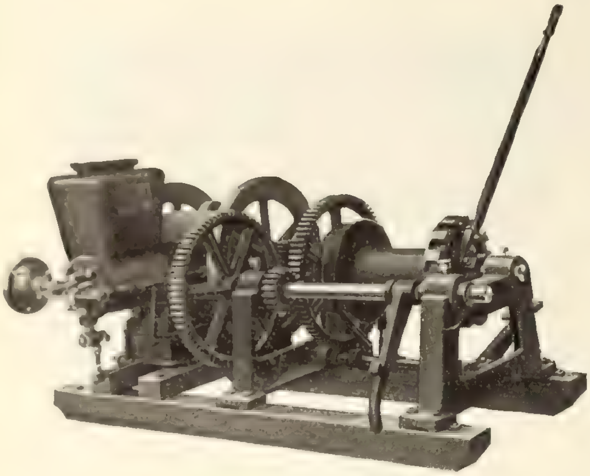
HOISTING ENGINES

Three Great Sellers



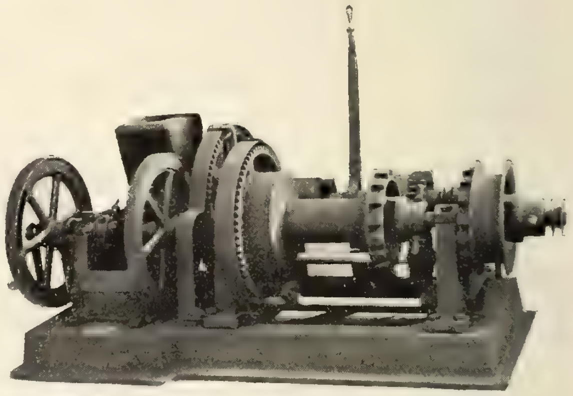
Champion Single Drum Hoist
Described in Catalog No. 23-A

The Champion Single Drum Hoist, capacity 3,000 pounds, direct connected to any kind of power.

The Champion Reversible Builders Hoist, capacity 3,000 pounds, direct connected.

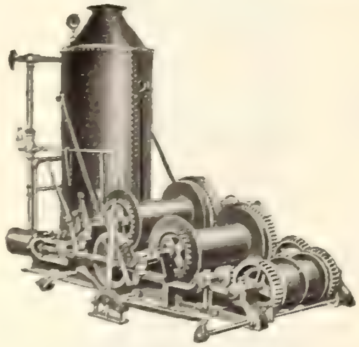
These two hoists are exceptional value.

Send for our Catalog.



Champion Reversible Builders Hoist
Described in Catalog No. 28-B

Standard Steam Hoisting Engines are well known, always on on the job, always doing good work. Boilers pass all specifications. Engines made in all sizes.



Steam Hoisting Engine

SEND FOR CATALOG NO. 23—STATE REQUIREMENTS

London Concrete Machinery Co., Limited

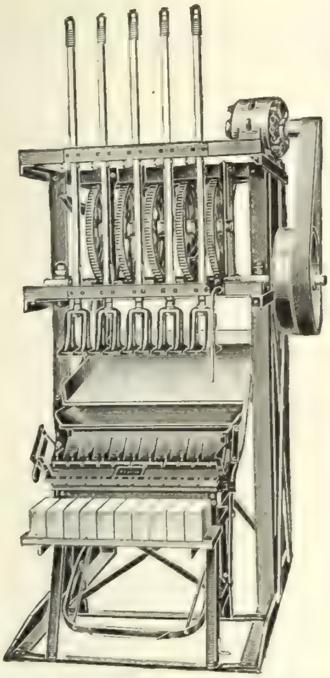
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES:

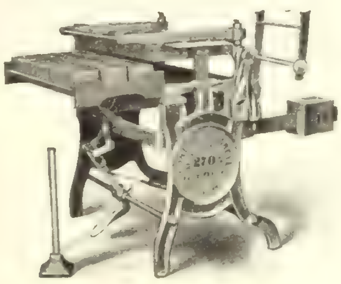
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D. McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES:

Vancouver—B. C. Equipment Company.
Montreal, P.Q.—Foss & Hill Machinery Company.
Port Arthur, Ont.—Northern Agency Company.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Company of Canada.



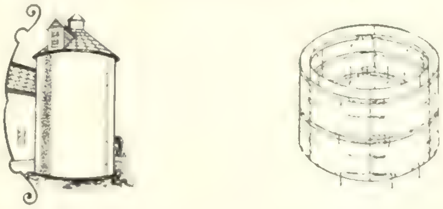
Perfect Brick Machine and Power Tamper. Capacity 20,000 bricks per day. Send for Catalogue No. 4-A-0



London Cement Pressed Brick Machine. Capacity 5,000 bricks per day. Send for Catalogue No. 4A.

Perfect Cement Brick Machine. Capacity 5,000 bricks per day. Send for Catalogue No. 4-A.

London Adjustable Concrete Block Machine—adjustable to all sizes of blocks.
Send for Catalogue No. 3.



London Adjustable Concrete Silo Curbs builds a Concrete Silo any size. Send for Catalogue No. 10.

Roughen Street Gauges, adjustable to any grade. Pays for itself in two weeks' use. Send for Catalogue No. 8 showing our street gauge and sidewalk forms

London Concrete Machinery Co., Limited

Cabell St. and Kitchener Ave., LONDON, ONT.

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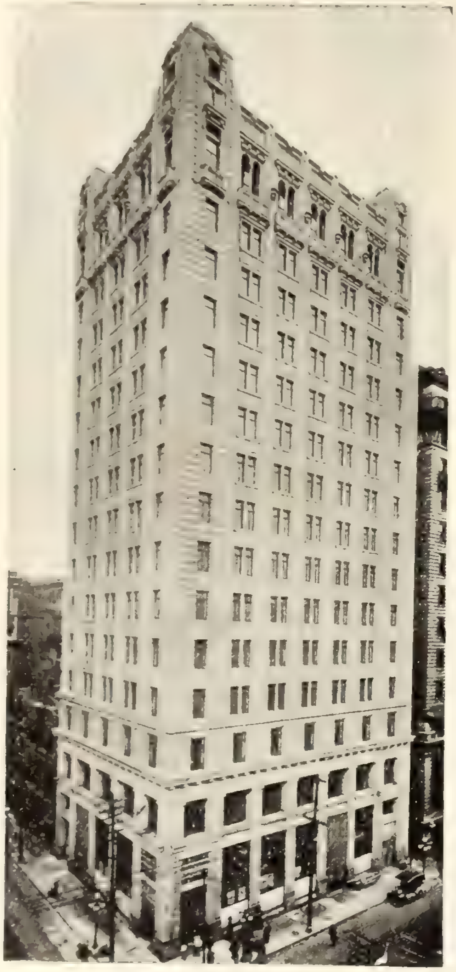
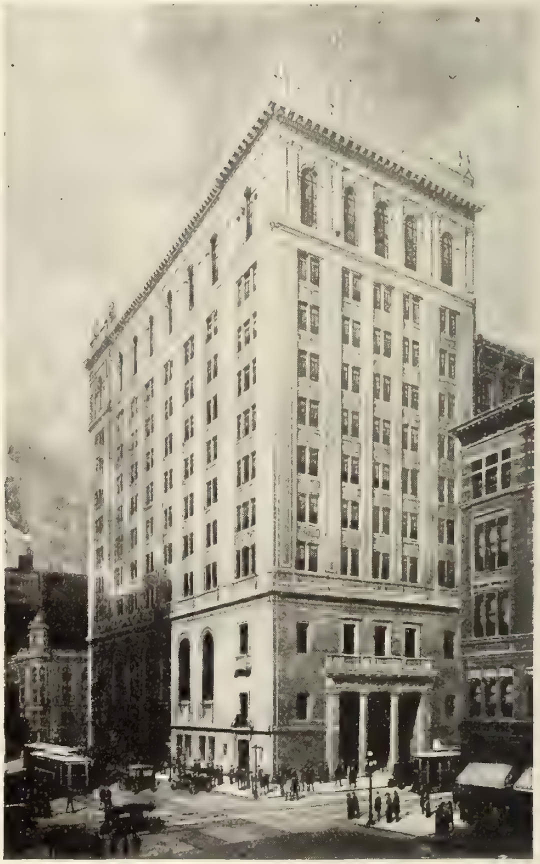
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Company of Canada.

THE NORTHWESTERN TERRA COTTA COMPANY



C. P. R. OFFICE BUILDING
Darling & Pierson, Architects



DOMINION BANK BUILDING
Darling & Pierson, Architects

Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

Why Zouri Store Fronts are *best*

Specify the Zouri Setting---Give Your Clients an Attractive Store Front

The contractor who has the best interests of the builder at heart will co-operate with him and show him he can make his store front a valuable asset—by making it attractive.

In these days of stiff competition the merchant depends a deal upon his front to bring him in business—more, perhaps, than he realizes.

What you can do Mr. Contractor, is to show him the most economical way to get an **attractive** front, namely, to have the plate glass set in the

Zouri SAFETY & BURGLAR-PROOF SETTING FOR PLATE GLASS

OPERATING UNDER MURNANE AND MARR PATENTS

It is easily and quickly set in place, and the method of securing indirect pressure on the glass eliminates the danger of breaking, thus giving the owner added glass insurance.

The Zouri System makes an inviting and durable store front. It is pleasing to the eye from both inside and out. There are no unsightly screwheads in view. Even the fastenings are completely hidden.

The most important thing to consider in modern store front construction is drainage and ventilation. The Zouri Sytem insures perfect ventilation and drainage.

The Zouri Setting is built to last. It will give service year after year. It is made of solid copper with steel reinforcing.

You make the store owner your friend for life if you show him the advantages of the Zouri System.

Send us the name of the owner of the next store building you put up, and we will send him detail sheet and full particulars of the Zouri System. And we would like to send these to you, if you haven't the information already.

Zouri Drawn Metals Company

General Offices and Factory: 227-241 W. Schiller St., Chicago, Ill.

CANADIAN AGENTS: W. H. Clark & Co. Ltd., Edmonton, Alta. Cushing Bros. Co., Calgary, Alta.
Saskatchewan Supply Co., Ltd., Saskatoon, Sask.

MARSHALL Crude Oil Engines

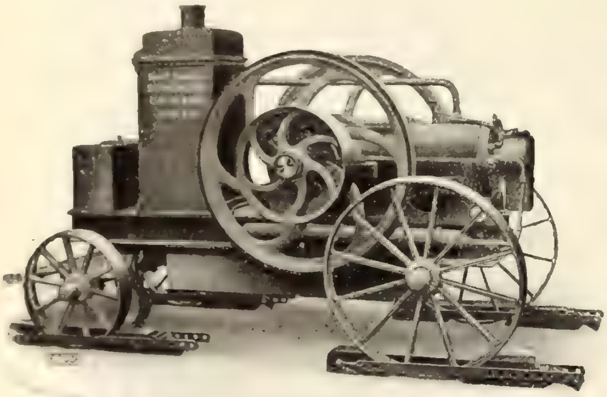
(SEMI-DIESEL SYSTEM)

Stationary and Portable

MARSHALL Steam Road Rollers.

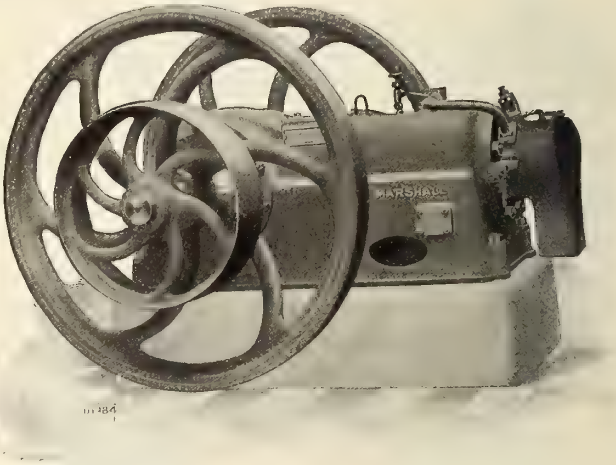
MARSHALL Gasoline Tractors for Road Grading, Hauling and Farm Purposes,

All high-class construction. Made in England by Marshall Sons & Co., Limited, Gainsborough, whose works cover over 40 acres and who employ over 5,000 men. Established 1848.



PORTABLE CRUDE OIL ENGINE

Suitable for contractors. Sawing, threshing and all outdoor work.



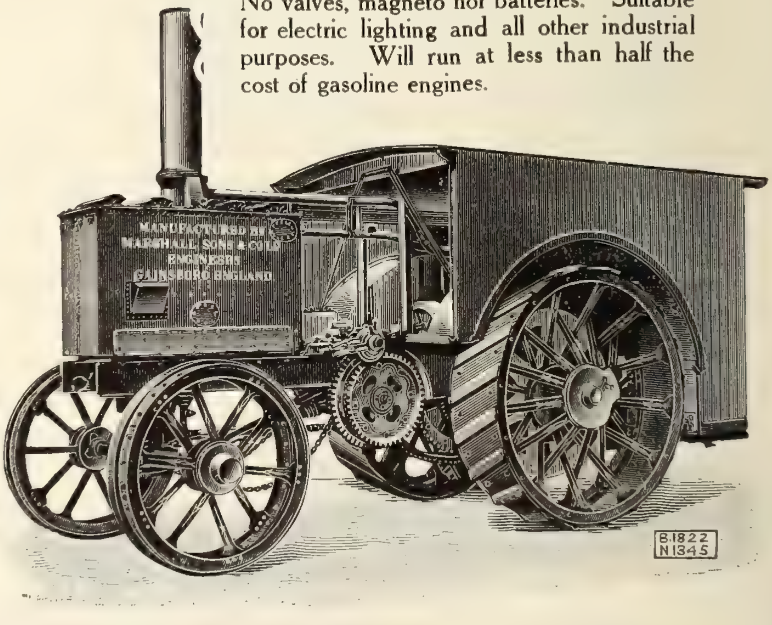
CRUDE OIL FIXED ENGINE.

Simplest and most economical engine made. No valves, magneto nor batteries. Suitable for electric lighting and all other industrial purposes. Will run at less than half the cost of gasoline engines.

The Famous MARSHALL Gasoline Tractor

The "Dreadnaught of the Prairies."

A proved success.
Built like a battleship—
Runs like a watch.
For hauling road graders.
Plowing, threshing, etc.
Absolutely reliable and durable.



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MARSHALL SONS & CO., (CANADA), LTD.

SASKATOON Engineers SASK.

P.O. Box 1564 Telephone 3393

DUNLOP

DUNLOP HIGH SPEED BELTS

Ideal for the purpose intended. Light or heavy duck. No stretching. Maximum adhesion.

DUNLOP CONVEYOR BELTS

Vertical Suspension of Conveyor Belting, as in the case of Mines and Quarries, calls for emphasis on strength and uniform quality. We use a tightly woven duck and a rubber friction of great holding power which permanently unites the different plies. That's why Dunlop Belting doesn't deteriorate.

DUNLOP MAIN DRIVE BELTS

Stand up under any tests—no matter how irregular and severe. No separation of plies. No rotting of duck from dampness. No abnormal stretching.

DUNLOP PNEUMATIC TOOL HOSE

Plain or Corrugated Cover. Wire wound if desired. Impervious to oils; light and flexible. Easily handled.

"HERCULES" Braided, Corrugated withstands 500 lbs. Pressure

DUNLOP GASOLINE HOSE

Specially made to withstand chemical action of gasoline. Lasts much longer than metal tubing and gives motorists greater satisfaction.

Wire-Wound, Round, Half-Round or Flat.

DUNLOP STEAM HOSE

Compounded to resist the action of steam under varying temperatures. Plies of fabric are impregnated with highest quality of steam-resisting rubber and the whole compressed into an inseparable unit.

DUNLOP "SUNSET" HIGH PRESSURE PACKING

Remains soft on the hottest joint. That flexibility gives it the necessary "life" to withstand the highest pressures. A perfect packing for all joints and immune to the effects of steam, alkalies, ammonia.

The Dunlop line consists of Tires for Automobile, Motor Truck, Bicycle, Motorcycle and Carriage, Rubber Belting, Packing, Heels, Hose, Mats, Tiling and General Rubber Specialties.

Dunlop Tire & Rubber Goods Company, Limited

Head Office and Factories:

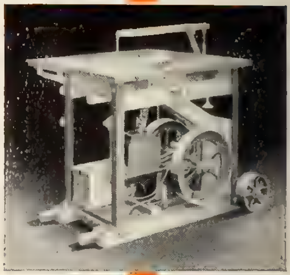
TORONTO CANADA

Branches:

[illegible] [illegible] Ottawa Vancouver Winnipeg
Montreal [illegible] [illegible]
St. John, N.B. Calgary Hamilton
[illegible] [illegible]

C.H.&E.

Portable Saw Rigs

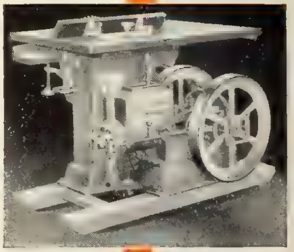


No. 3
Saw Rig

WHEN you have a great amount of sawing on the job, any one of these Portable Saw Rigs will do your work with ease.

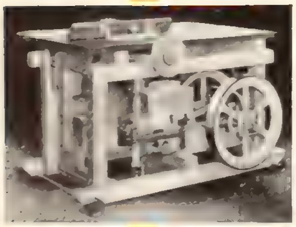
Any one of these Portable Saw Rigs will do all of your millwork on the job from the lightest carpenter work to the heaviest concrete form lumber and lumber yard work.

No. 1
Saw Rig

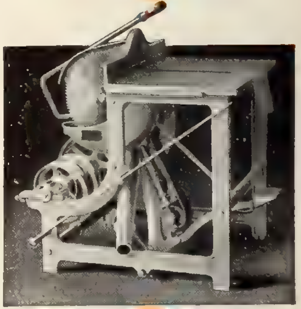


No. 2
Saw Rig

ON THE JOB



No. 1-A
Saw Rig



No. 5
Saw Rig

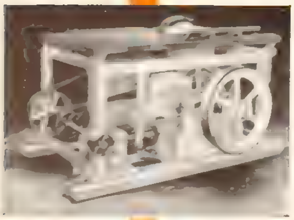
A LARGE illustrated catalog fully describes this complete line of Portable Saw Rigs. We do not want you to forget that we are the PIONEER builders of this line and that we manufacture each and every outfit complete from engine up in our own shop.

Stock Carried by

F. H. Hopkins & Company, Montreal

Dominion Equipment & Supply Company
Winnipeg Vancouver

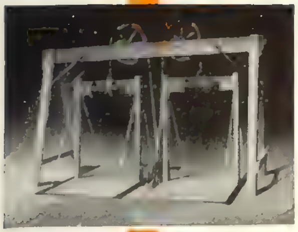
Canadian Equipment & Supply Company
Calgary Edmonton Regina



No. 4
Saw Rig

—Manufactured by—

C. H. & E. MANUFACTURING CO., Inc.
Milwaukee - Wisconsin

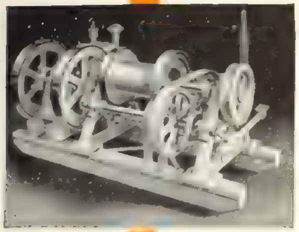


Material
Elevator

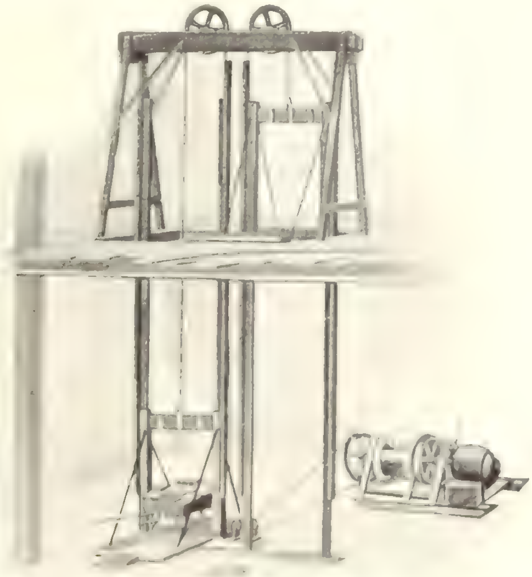
Contractors' Equipment

CHE
Mfg. Co.

GOOD, dependable machinery built for service, efficiency and economy is what you want on the job. Why let your men tire themselves pushing a hand saw, carrying a hod of brick or mixing mortar with an old style hand hoe?



Gasoline
Hoist



Trench
Pump

Mortar
Mixer

Air
Compressor

IF you are looking for good reliable engine power the C. H. & E. engine without question will give efficiency, economy, constant service and simplicity of operation.

Write for our well illustrated catalog, describing our complete line of Contractors' Equipment.

Stock Carried by

F. H. Hopkins & Company, Montreal

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Manufactured by
C. H. & E. MANUFACTURING CO., Inc.
Milwaukee - Wisconsin

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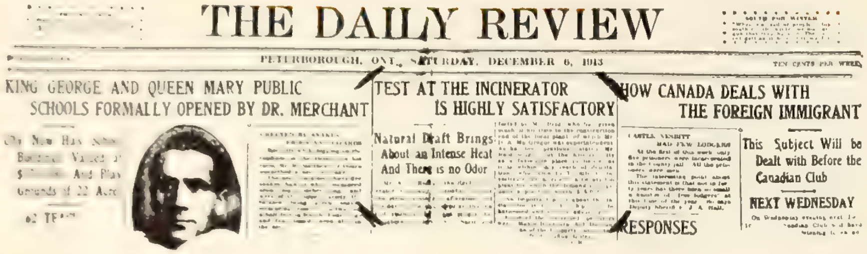
The Reid Incinerator

Smokeless **Odorless** **Economical**


THE DAILY REVIEW

PETERBOROUGH, ONT., SATURDAY, DECEMBER 6, 1913

TEN CENTS PER WEEK

KING GEORGE AND QUEEN MARY PUBLIC SCHOOLS FORMALLY OPENED BY DR. MERCHANT

TEST AT THE INCINERATOR IS HIGHLY SATISFACTORY

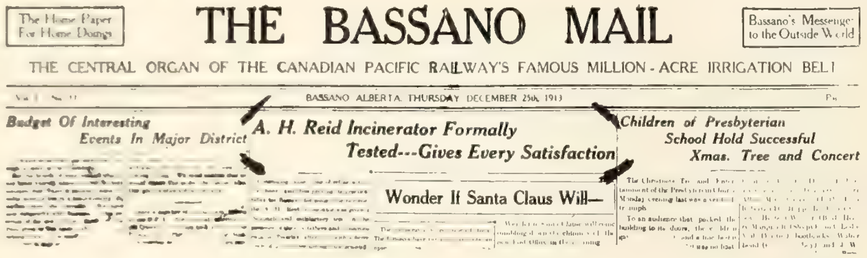
Natural Draft Brings About an Intense Heat And There is no Odor

HOW CANADA DEALS WITH THE FOREIGN IMMIGRANT

This Subject Will be Dealt with Before the Canadian Club

NEXT WEDNESDAY

RESPONSES


The Home Paper For Home Doings

THE BASSANO MAIL

Bassano's Messenger to the Outside World

THE CENTRAL ORGAN OF THE CANADIAN PACIFIC RAILWAY'S FAMOUS MILLION-ACRE IRRIGATION BELT

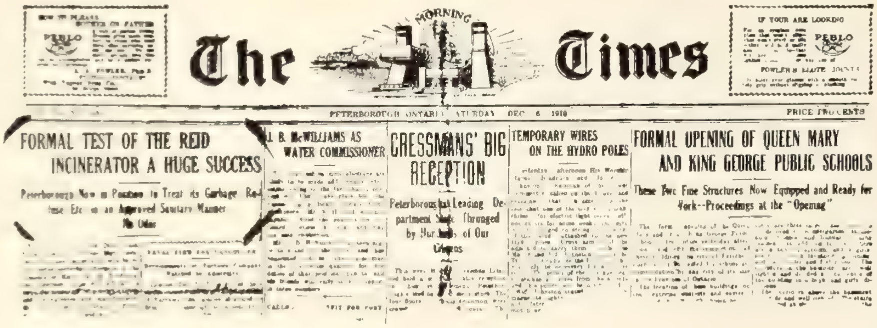
BASSANO ALBERTA THURSDAY DECEMBER 25th 1913

Budget Of Interesting Events In Major District

A. H. Reid Incinerator Formally Tested---Gives Every Satisfaction

Wonder If Santa Claus Will—

Children of Presbyterian School Hold Successful Xmas. Tree and Concert


The MORNING Times

PETERBOROUGH ONTARIO SATURDAY DEC 6 1913

FORMAL TEST OF THE REID INCINERATOR A HUGE SUCCESS

Peterborough Now in Position to Treat its Garbage Refuse Etc. in an Approved Sanitary Manner

No Odor

B. McWILLIAMS AS WATER COMMISSIONER

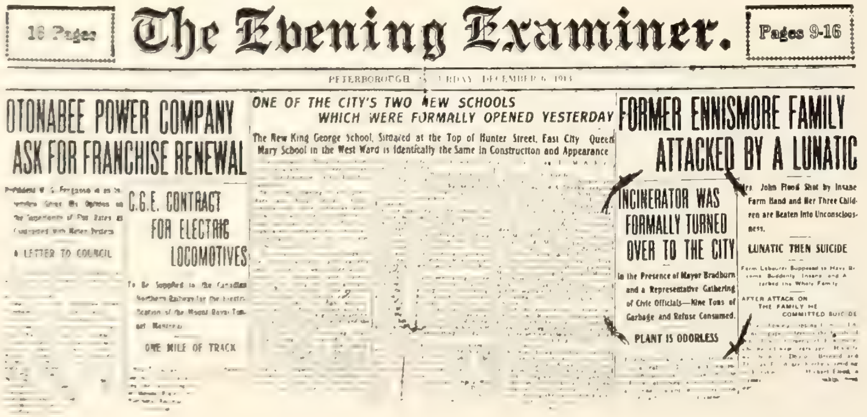
CRESSMANS' BIG RECEPTION

Peterborough's Leading Department Store Thronged by Hundreds of Our Citizens

TEMPORARY WIRES ON THE HYDRO POLES

FORMAL OPENING OF QUEEN MARY AND KING GEORGE PUBLIC SCHOOLS

These Two Fine Structures Now Equipped and Ready for Work--Proceedings at the "Opening"


16 Pages

The Evening Examiner.

Pages 9-16

PETERBOROUGH SATURDAY DECEMBER 6 1913

OTONABEE POWER COMPANY ASK FOR FRANCHISE RENEWAL

A LETTER TO COUNCIL

C.G.E. CONTRACT FOR ELECTRIC LOCOMOTIVES

ONE MILE OF TRACK

ONE OF THE CITY'S TWO NEW SCHOOLS WHICH WERE FORMALLY OPENED YESTERDAY

The New King George School, Situated at the Top of Hunter Street, East City. Queen Mary School in the West Ward is Identically the Same in Construction and Appearance

FORMER ENNISMORE FAMILY ATTACKED BY A LUNATIC

INCINERATOR WAS FORMALLY TURNED OVER TO THE CITY

In the Presence of Mayor Bradburn and a Representative Gathering of Civic Officials—Nine Tons of Garbage and Refuse Consumed.

PLANT IS ODORLESS

Mrs. John Flood Shot by Insane Farm Hand and Her Three Children are Beaten Into Unconsciousness.

LUNATIC THEN SUICIDE

AFTER ATTACK ON THE FAMILY HE COMMITTED SUICIDE

Made in various sizes for the rapid, convenient and economical disposal of garbage in cities and towns.

The Reid Incinerator is built on a newly-patented plan, invented and perfected by Mr. A. H. Reid, who has for many years made a study of effective and economical means for the disposal of garbage. Incinerators of our make have been installed for the cities of Peterboro', Ont., Haileybury, Ont., and Bassano, Alta. These test installations have given the greatest possible satisfaction. The secret of the Reid Incinerator's success is the patented hot-blast tubes which insure rapid and perfect combustion. From a sanitary standpoint this feature is invaluable as it absolutely does away with smoke and obnoxious odors.

Refuse and Garbage Destroyed at Approximately 25c. a Ton!

The minimum first cost and the low cost of operation have placed our incinerator far ahead of any other on the market from a purely economical view-point. The Reid Incinerator will destroy garbage at a cost of approximately 25 cents a ton, as against the forced-draft and coal-fired methods of other incinerators at 45 cents and $1 a ton respectively. The cost of burying garbage is about 60 cents a ton. These figures have been proven by actual tests.

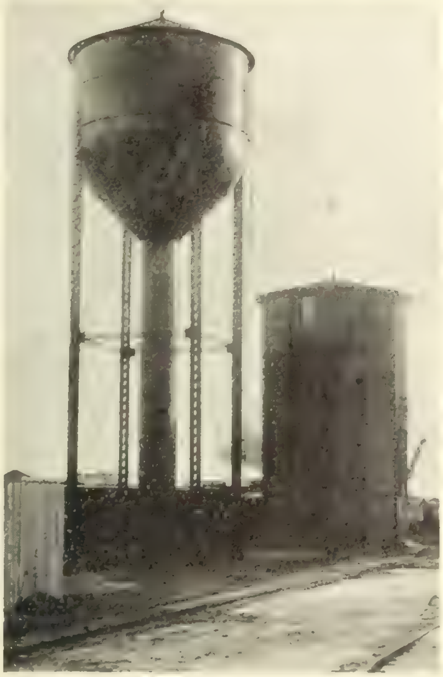
Illustrated catalogue upon request.

A. H. Reid Incinerator Company

69 Rowanwood Avenue, Toronto —OFFICES— 605 Standard Bank Bldg., Toronto

Pittsburgh-Des Moines Steel Company

(Formerly Des Moines Bridge and Iron Co.)



BIGGAR SASK.
Capacity 100,000 gals. 50 ft. to bottom.
One of 29 built for Grand Trunk Pacific R.R.

Elevated Steel Tanks

Hemispherical and Segmental Bottoms.

We make a speciality of the design and construction of steel water tanks, both on towers and of the standpipe type.

Our factory is located at PITTSBURGH, PA.—the source of the steel supply—and we can therefore make prompt shipments and name the lowest prices consistent with first class workmanship.

We Solicit Your Inquiries.

OFFICES:

Pittsburgh, Pa.	945 Curry Bldg.
New York City	42 Church St.
Dallas, Texas	Praetorian Bldg.
Des Moines, Iowa	938 Tuttle St.
San Francisco, Cal.	Monadnock Bldg.
Montreal, Que.	F. H. Hopkins & Co.

Type O Thew Shovel Handles Large Output

Type O Thew on Railroad Construction

With proper facilities for removing material from shovel promptly, large outputs can be handled with a Type O Thew. The following results secured on the work shown in the cut will be of interest:

DAILY SHOVEL REPORT

Date—April 17, 1914.
Contract—Grand Rapids and Northwestern Railway.
Shovel—Type O Thew.
Hours—10, Delay—½ hour, Actual hours—9½.
Material—Sandy loam.
Special Obstacles—None.
Cause of Delay—Train wrecked.
Weather—Fair and warm.
Shovel Crew—Engineer, Fireman and 2 Laborers.
Length of Haul—3,000 Feet.
Laborers on Track—6.
Laborers on Dump—9.
[illegible] Men—5.
Teams Hauling—8.
Size of Cars—1½ cubic yards.
Number of cars loaded—[illegible]44.
Cubic yards handled—[illegible]—592.
Remarks: Cars loaded at side of shovel.
[illegible]

USE A THEW—IT PAYS.

Our catalogue describes this shovel and is yours for the asking.

The Thew Automatic Shovel Company, - Lorain, Ohio

Photographs show C.P.R. subways at North Toronto built by us during the summer of 1913. These pictures were taken at different stages during Construction. Excavation and Concrete work on these four subways were practically completed in four months time.

We also have contract for Yonge St. Subway at North Toronto.

Wells and Gray, Limited

ENGINEERS AND CONTRACTORS

Branch Office:
Manning Chambers,
WINDSOR, ONT.

247 Confederation Life
Building,
TORONTO

We are equipped to do all kinds of heavy Concrete work, excavation and all classes of Building Construction.

Wells and Gray Limited

ENGINEERS AND CONTRACTORS

BRANCH OFFICE:
Manning Chambers,
WINDSOR, ONT.

247 Confederation Life
Building,
TORONTO, ONT.

Batch Mixer Prices

Every Contractor Can Afford

Save 25 to 50 per cent. on a mixer and get the best machine on the market. An unusual opportunity for the live wire who is interested in modern cement making machinery.

We can make these prices because of our exceptional manufacturing advantage. We are located at Keokuk, the site of the 200,000 h.p. dam. This cheap power cuts our expenses. Immense output and standardized parts tell the rest of the story.

These mixers cost us less to make and you get them for less. There's the long and short of it.

Steel King and Little Boss mixers are made of steel instead of cast iron. Costs you less and gives you a stronger, lighter machine.

Complete line cement batch mixers, hoists, side loaders, engines, diaphragm pumps, etc.

Steel King

10 FOOT SIZE.

Costs less than the heavy, cumbersome cast iron mixers. Is stronger and 1,000 lbs. lighter. Has 640 lbs. less drum dead weight on engine. Saves fuel. Saves engine pounding.

Mixes and remixes 40 times in 30 seconds. Takes full sack of cement. Capacity 140 yards daily. Discharges 12 barrows a minute. Special drum creates criss-cross mixing action. Thoroughly cleans itself at every discharge.

Low down hopper. Barrows charge direct without shovelling. Chain drive with automatic clutch. Builder's hoist.

LITTLE BOSS MIXER

5 H.P.—50 Yd. Capacity—3 H.P. Engine

A little smaller than the Steel King and selling at a lower price, but has the same mechanical principles.

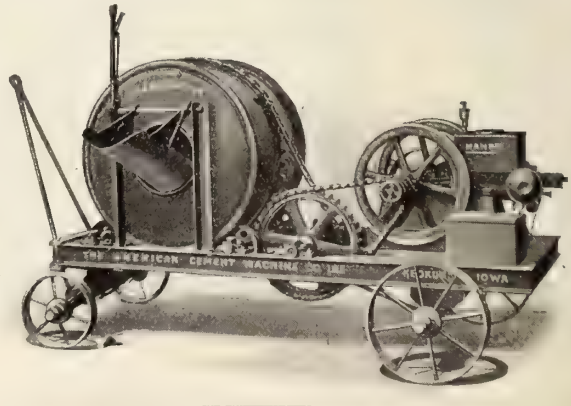
The Little Boss is a quarter-yard mixer with a daily capacity of 40 or more cubic yards. Handles a full sack of cement. Does 80 per cent. of all concrete work. Equals machines costing twice as much.

Every contractor who has used this machine is pleased with results. They wonder how we can build it as well as we do and sell it at our low price.

These Reliable Durable Mixers Are Sold Under 2-Year Guarantee and 30 Day Trial.

We want every contractor in Canada to know our line. We're not afraid of investigation or the most rigid tests. You can try the Steel King or Little Boss 30 days before the sale is closed. What can be more fair? The contractor who once tries one of these mixers will never want to let go of it.

Reliable representatives wanted in all parts of Canada. Good proposition to the right party.



The American Cement Machine Co.

(Incorporated)

2,000 Johnson St. **Keokuk, Ia.**

Investment *versus* Speculation

BITULITHIC

is an asset. It is an investment *not* a speculation.

Investigate Bitulithic before determining to use inferior street paving. It is cheaper to have good pavement in the beginning than to contract for cheap constructions which have to be repaired every year.

There is no guess work in the construction of Bitulithic pavement. It is made of varying sizes of the best stone obtainable, combined with bituminous cement and laid under close laboratory supervision. You must realize that quality is remembered long after the price is forgotten. The character of a city is indicated by the condition of its streets.

Kinistino Ave., North from Jasper Ave., Edmonton, Alta.

Bitulithic is — Unequalled in Reputation
Bitulithic is — Unquestioned in Quality
Bitulithic is — Unrivalled in Popularity
Pavement of Prestige — Bitulithic

DO NOT HESITATE—investigate at once—specify Bitulithic and have a pavement which is "built up to a high standard and not down to a low cost"—the pavement of quality.

Write today for explanatory booklets and learn more about this modern pavement for modern cities.

Warren Brothers Company

Executive Offices: 59 Temple Place, Boston, Mass.

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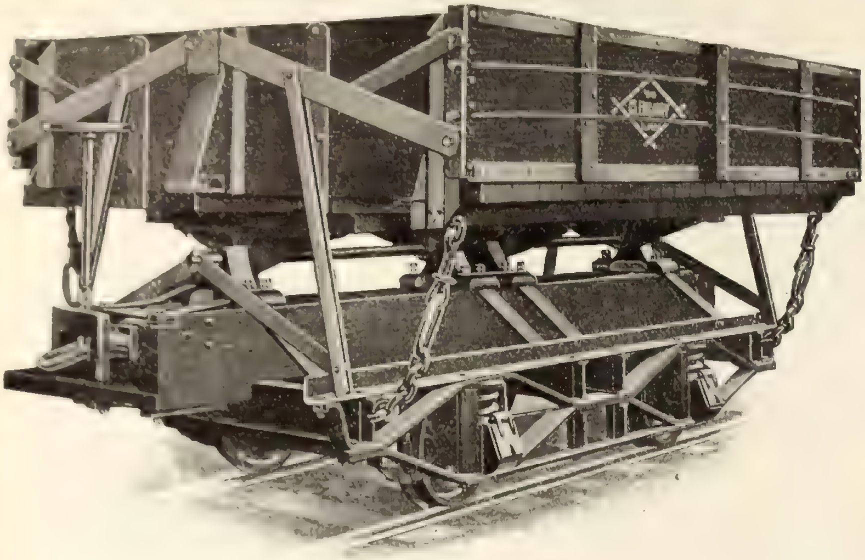
Portland, Oregon
Journal Bldg

Phoenix, Arizona.
204 Noll Bldg

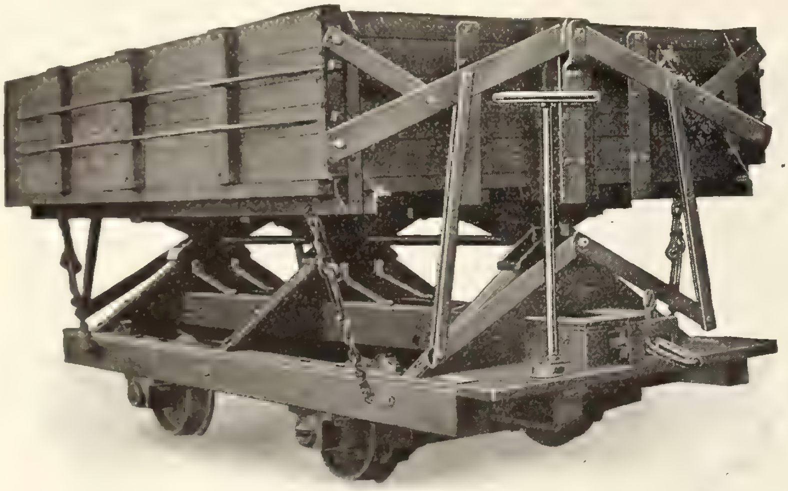
Nashville, Tenn.,
606 First Nat'l Bank Bldg

St. Louis, Mo.,
Railway Exchange Bldg.

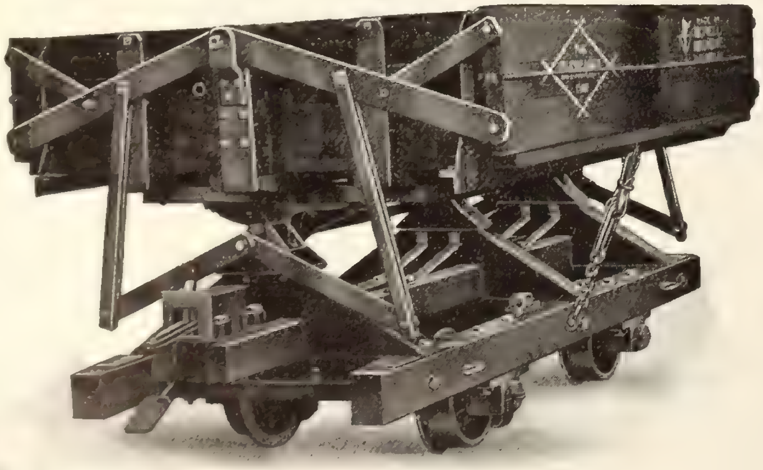
Richmond, Va.
Virginia Railway & Power Bldg



4 and 6 Yard Double Diamond Steel Frame Side Dump Car. The latest in Cars. Get posted on all the points of these cars.



2 and 3 Yard Wood Frame Side Dump Car. These are time tried favorites of their class. No better value offered critical buyers.



1½ Yard Wood Frame Side Dump Car. Great money-makers for hand shovelling.

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The Reliable Mark of Service on Dump Car Equipment

The lines of various cars illustrated have been adopted and in use for many years. We are headquarters for all kinds of handling equipment such as listed below. Any special equipment manufactured to order on short notice.

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Steel and Wood Frame Side Dump Cars.

Grasshopper End Dump Cars.

Plain End Dump and Rotary Side and End Dump Cars.

Flat Platform Push and Lorry Cars.

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Mine Cars Complete with Roller Bearing Wheels, and Steel or Wood Bodies.

Standard Wheels, Axles and Journal Boxings.

Hyatt Roller Bearing Mine Wheels and Axles for Mine Cars and Industrial purposes.

Sheet Steel Cars for all Industrial purposes.

Non-Freezing Hydrants.

Send Us Your Enquiries For Prompt Quotation

The
Schell Foundry & Machine Company
Limited
Alexandria - Ontario

GLENGARRY

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Our plant is well equipped for handling special work pertaining to handling equipment of various kinds. Railway Contractors, Construction Companies and Engineers on various works are requested to send us their enquiries.

When You Buy "Glengarry" Made Goods You Are Buying Right All Round!

Get our prices and begin to save money and delay. We offer reliable goods and best possible service to all.

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We have overcome the freezing trouble with Hydrants. The construction of our goods is along Underwriters' Standards. By a simple device the bane of severe weather is REMOVED. No frost cases required. Just plain commonsense design. And our Hydrants have full free waterway and one piece construction. Study the cuts. Write for quotations and full details.

The Only Advance in Hydrants in the Past Three Years

The
Schell Foundry & Machine Company, Limited
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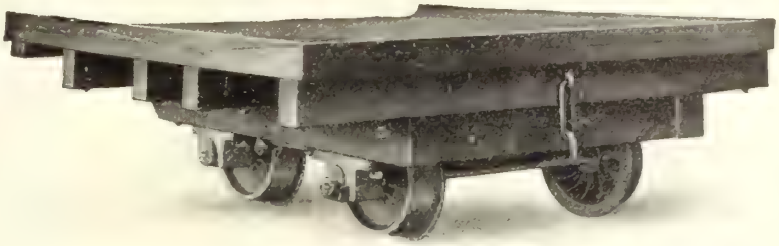
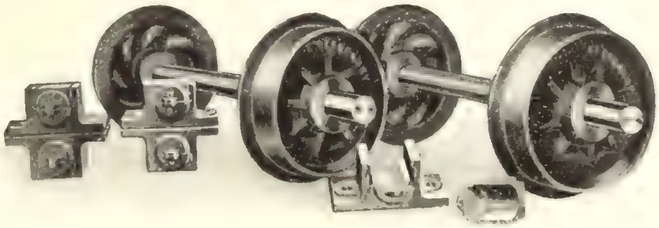
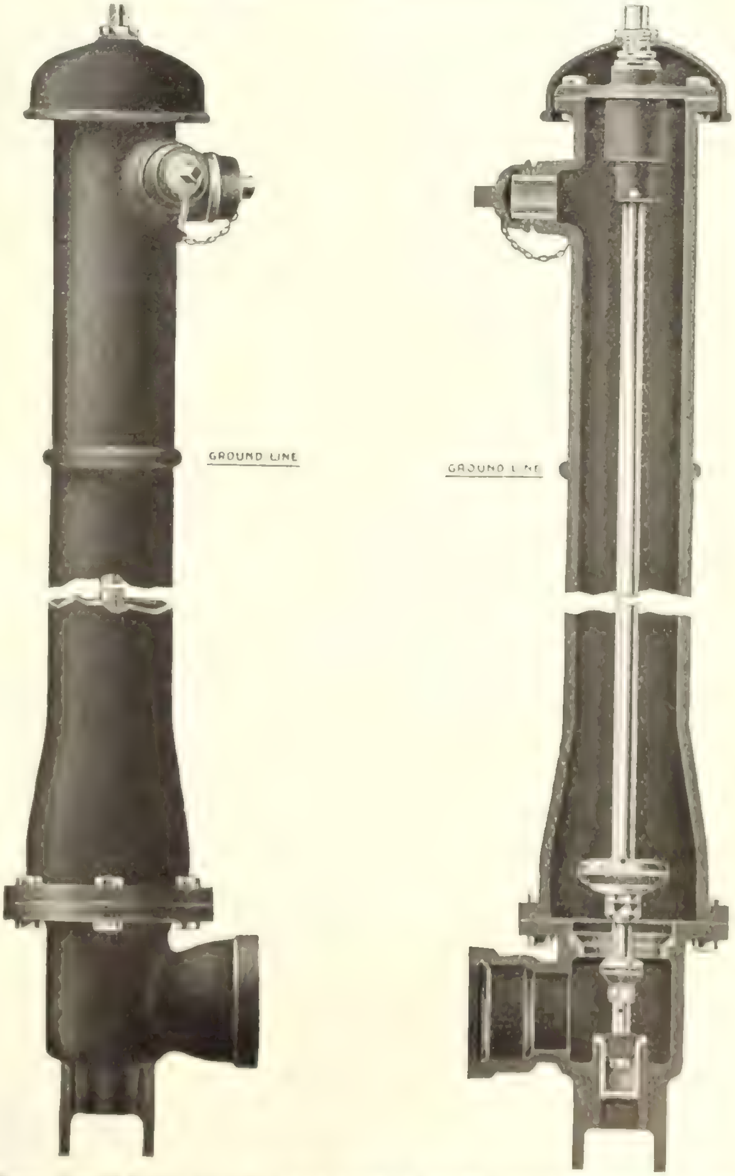


Grasshopper End Dump Rock Car. The greatest little car ever designed, for boulders, etc.



Our Standard Wheel Sett Equipment, showing our Babbitted Oil Tray Axle Boxing Construction



Frost Proof Hydrants that are really proof against freezing. This is a hydrant that will stand close inspection. Absolutely no freak ideas.

County Academy, Sydney, N. S. Built of Sydney Pressed Brick

Our plant is the only one of its kind in Canada making pressed brick from blast furnace slag. Brick made from this material is hard as flint—hardens with age and adheres with great strength to mortar.

Prices and Particulars on Request

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Limited
Sydney, Nova Scotia

Ask your dealer for

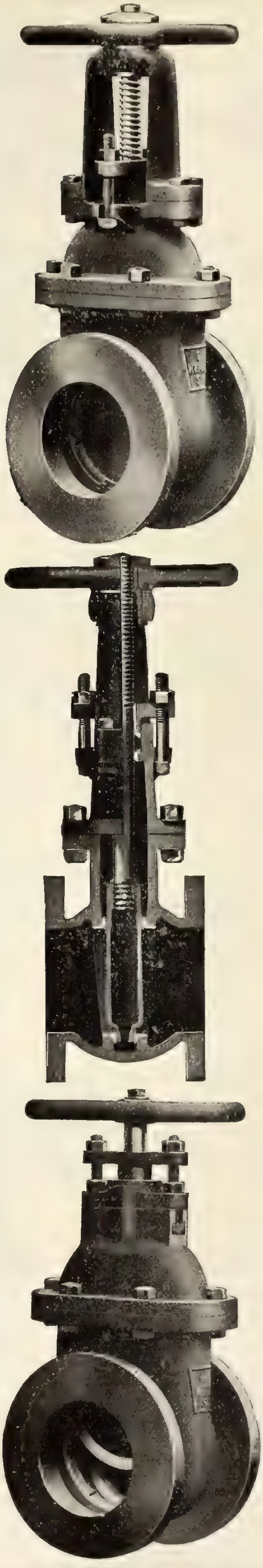
MANTON BROS.

Mortar Colors

Tur-Min-Tine
(Mineral Turpentine)

"Creosote Shingle" Stains

MANTON BROS.
105 Elizabeth St. TORONTO



The KERR "Keystone" Iron Body GATE VALVES

are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

If you are particular about the valves you specify or buy, you will not only **specify, but demand Kerr (Keystone) Iron Body Gate Valves.**

Any **Kerr Valve** lends class and distinction to any steam or water job.

Manufactured and Guaranteed by

The
KERR
Engine Company
Limited
WALKERVILLE, ONT.

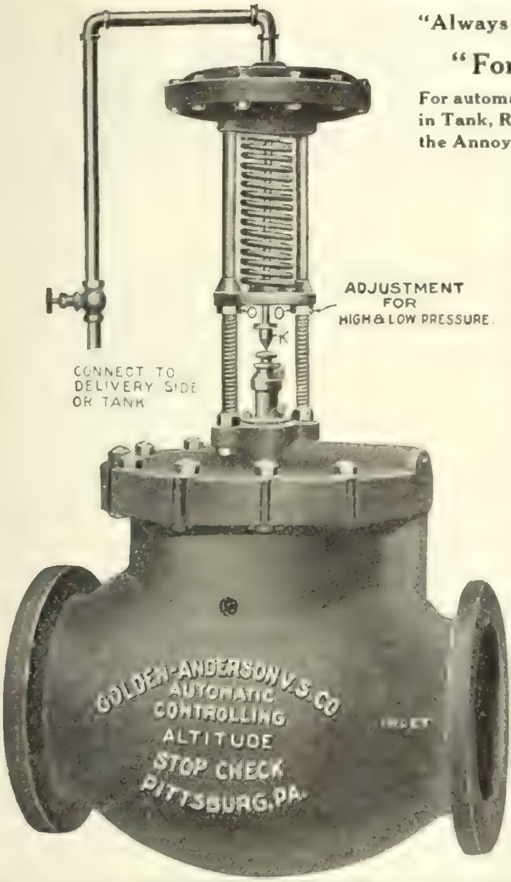
VALVES
and HYDRANTS
exclusive output.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

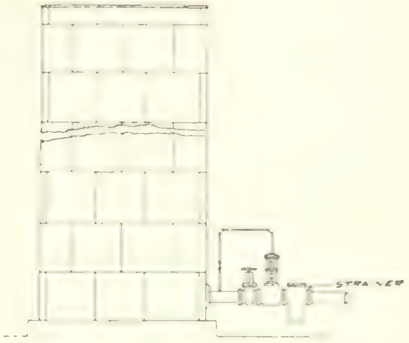
"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.

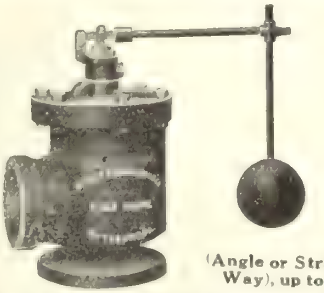


Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.

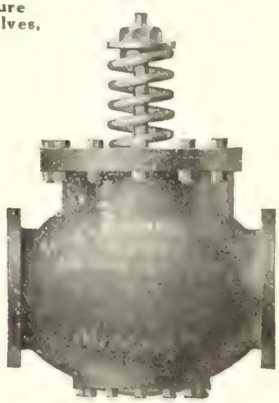


Automatic Cushioned Water Pressure Regulating Valves, up to 24

Golden-Anderson Float Valves



(Angle or Straight Way), up to 24



Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg., Pittsburgh, Pa.

"DULL"

Sand and Gravel Washing Outfits

We have perfected every device necessary for an up-to-date sand and gravel washing outfit and have a staff of competent engineers who can design and erect a plant of any capacity.

The illustration shows a "Dull" designed and equipped plant in successful operation in Grand Rapids, Mich. There are many such plants in operation in every part of the country.

We would like you to have our catalogue. It is sure to contain some equipment that would mean dollars to you if installed in your plant.

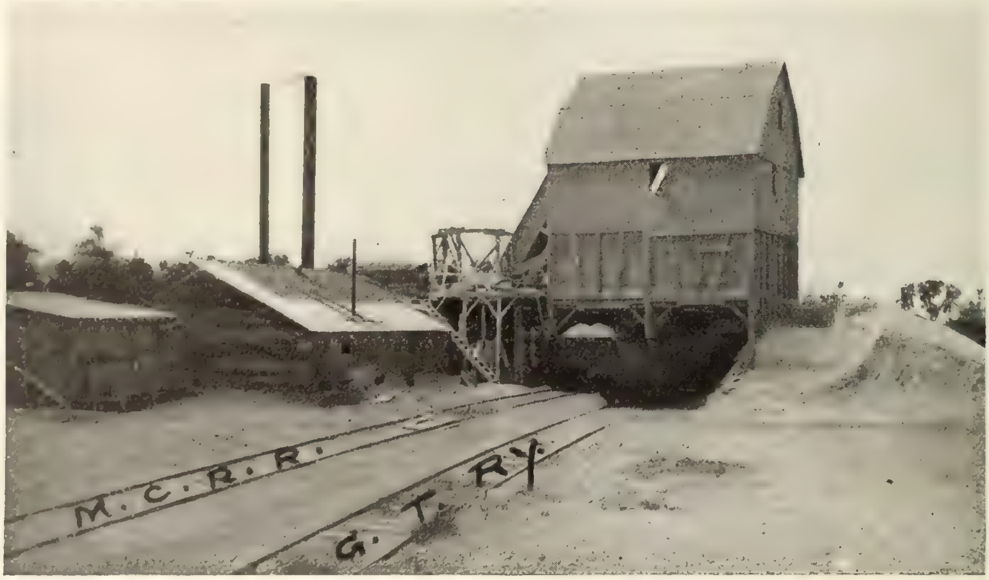
WRITE US TO DAY

The Raymond W. Dull Co., 719 Chamber of Commerce Bldg., Chicago, Ill.

CRUSHED STONE

For Concrete and Macadam

THE HARDEST STONE FOR MACADAM IN ONTARIO



Crushing Plant at Our Quarries

Capacity 1,000 tons per day.

The only quarry producing the famous **Hagersville Blue Stone.**

The Stone that made Hagersville famous.

Hagersville Contracting Co., Limited

Office and Quarries: Hagersville, Ontario

Correspondence Solicited

Stone delivered on G.T.R., M.C.R., C.P.R. and T.H. & B. Railways

Bell Phone No. 2

J. C. Ingles, Mgr., Hagersville, Ontario

HARD, TOUGH,

High Cementing Value

In test conducted by the Public Roads Office at Washington D. C., the following figures were obtained :

MATERIAL—LIMESTONE	
Specific Gravity	**2.65**
Weight per cubic foot	**165 pounds**
Water Absorption "	**0.93 "**
Hardness	**18.8**
Toughness	**12.**
Cementing Value	**Excellent**

The figures given for the Hardness, toughness, and cementing value are after the French method. As to weight at 165 lbs. is about 10 lbs. lighter than any other limestone in this section of Ontario and this alone gives our limestone an advantage of 6% in value ton for ton; that is in a ton of crushed stone there would be 6% more bulk in Hagersville stone than in a stone weighing 175 lbs.

In water absorption the amount given per cubic foot is almost as low as trap-rock and lower than any limestone we know of.

In hardness 18.8 is harder than any limestone and even harder than any trap rock in Southern Ontario.

In toughness not excelled by any limestone.

In Cementing Qualities classed as excellent, a record attained by few quarries.

We have an interesting circular containing further details of this test—write for a copy.

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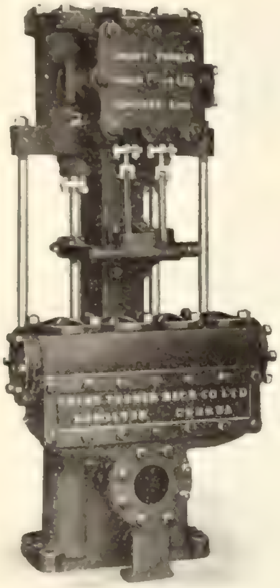
Why Not Buy The Best



when in the market
for

PUMPING MACHINERY?

Stock of pumps
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General Supply Co.
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The Smart-Turner Machine Co., Ltd.
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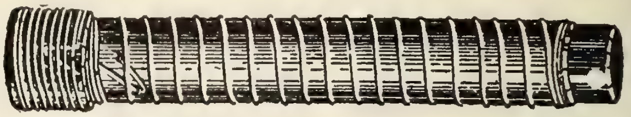

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RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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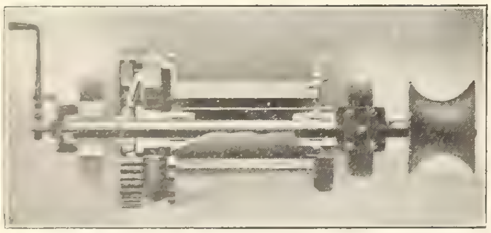
Full Particulars and Estimates Furnished

If You Had to Run It Yourself Which Engine Would You Choose?



Suppose you were engineer of a hoisting engine, operating a clamshell bucket or running a derrick that required fast, continuous work, which would you prefer—an engine with an easy operating friction; easy to throw in, easy to hold in, or one with a friction that required violent effort to throw it in and equally violent effort to hold it there? That's the difference between

"AMERICAN" EXPANSIVE TYPE FRICTIONS

and the cone type universally sold with other engines—a type in which it is necessary to push the whole drum across the shaft and hold it there by main strength. The strength and weight of the operator and the push of the thrust screw have to do the whole job.

"AMERICAN" Friction supplements the push of the thrust screw with the toggle action of the friction; this produces a thrust several times greater than the unassisted push of the thrust screw.

An untired operator is bound to get better results than one fagged out by needless tussling with a cumbersome machine.

The cool running "AMERICAN" friction; quick, positive, easy to operate, will save you money. Make us prove it.

—MADE BY—

AMERICAN HOIST & DERRICK CO
ST. PAUL, MINN.

SOLD BY—

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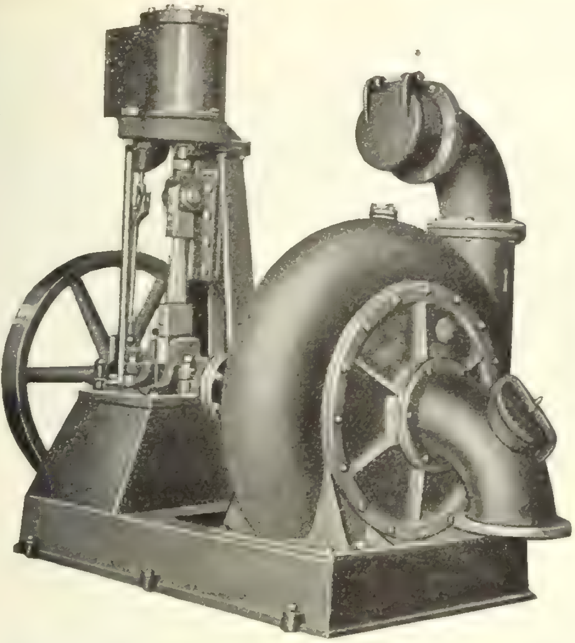

Contractors Sand and Dredging Pumps

Complete Hydraulic Dredging Machinery
Centrifugal and Turbine Pumps for Every Service

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Canadian Sales Agents—
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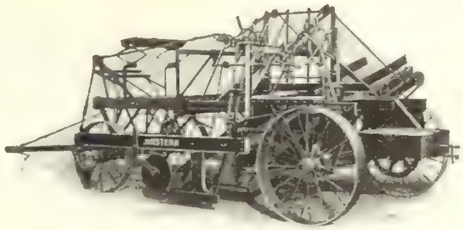

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is especially recommended for excavating canals, ditches and reservoirs, loading wagons, building levees and embankments and throwing up roadways.

Numbers of these graders are in use on railroad work and in building canals, and have been adopted by many contractors and highway officials engaged in earth handling.

If you have an excavating proposition in view, we invite you to write for our illustrated catalogue.

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Earth and Stone Handling Machinery
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A great advantage will be gained to consult us when considering the installation of a Heating and Ventilating System.

Our ***"Keith Fan"*** has come to the front in the Heating and Ventilating World and is considered by experts to be the most practical and economical Fan yet produced.

It will pay you to investigate ***"Keith Fans."***

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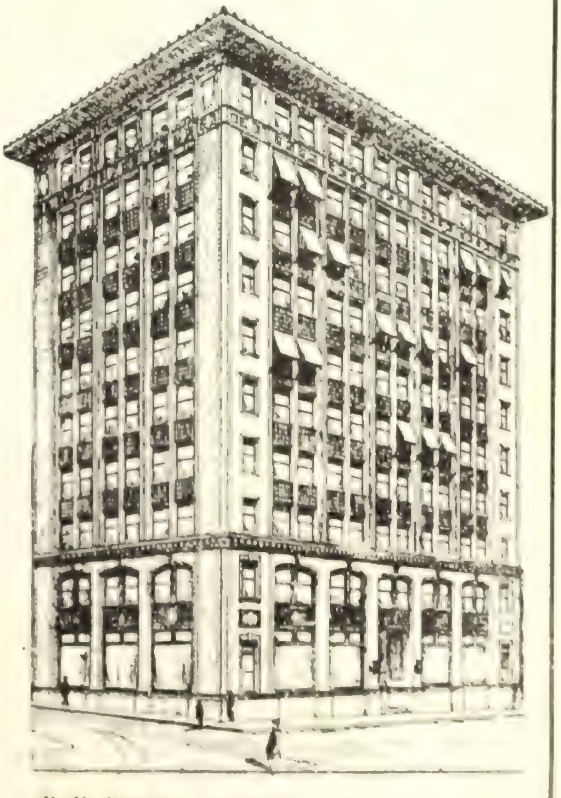
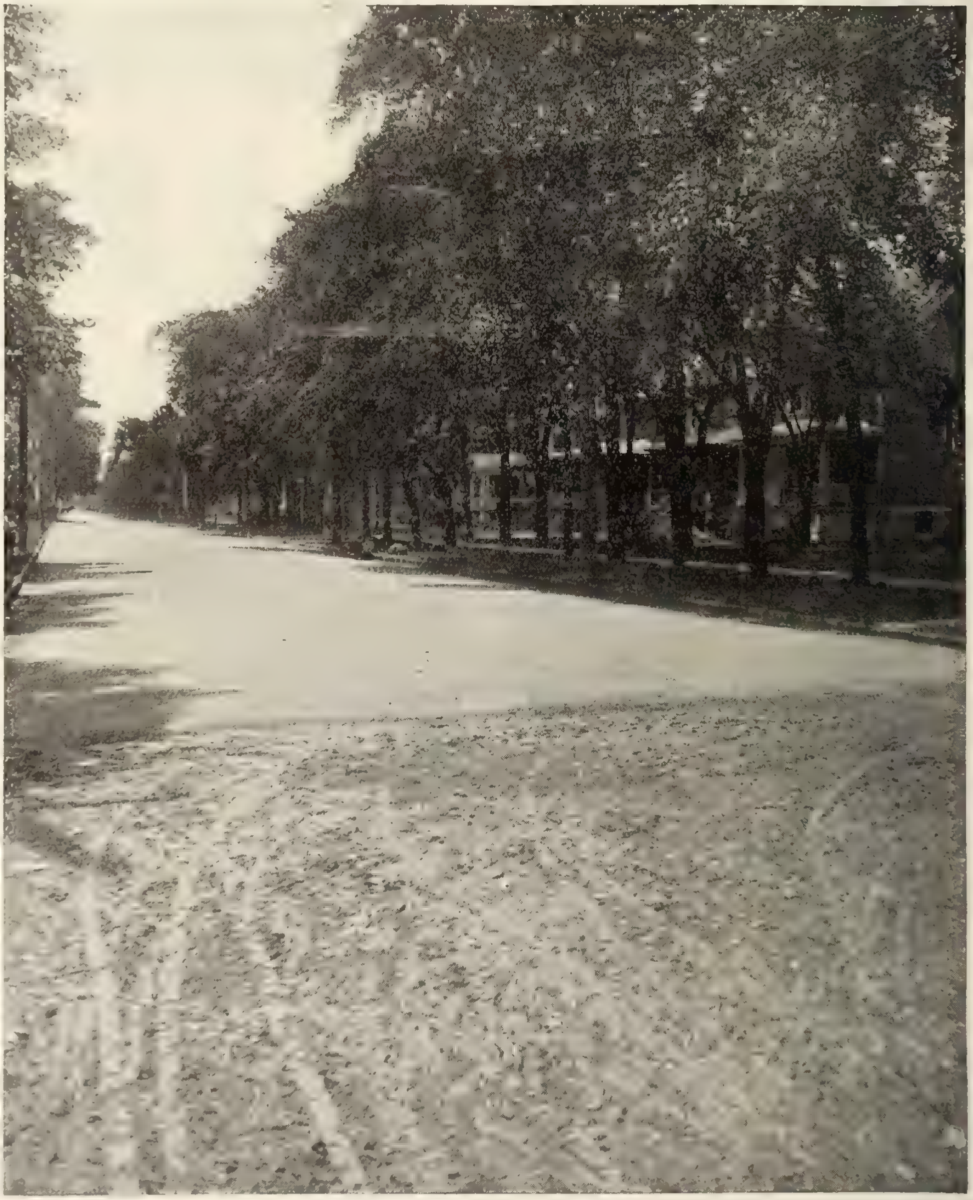
5. Herald Building, Architect, Brown & Vallance, Mon



R. E. Bostrom, Architect
McGill Building, Montreal

Trinidad Liquid Asphalt

This photograph tells the whole story of the difference between Trinidad Liquid Asphalt and ordinary road oils.



It shows two sections of Ridgefield Avenue, Oak Park, Ill. In the foreground is the oiled section. In the background is the section resurfaced with Trinidad Liquid Asphalt.

These two sections were built at the same time (June, 1912) under the same conditions and with the same materials — with the important exception of the bitumen.

The Trinidad Liquid Asphalt section was a good investment; the other work was money thrown away.

Applied hot or cold Trinidad Liquid Asphalt is a true constructive agent, not a temporary dust layer.

Ask for Trinidad Liquid Asphalt booklets.

The Barber Asphalt Paving Company

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Genasco Asphalt Expansion Joints have all the advantages of other prepared joints for concrete and block pavements and in addition to this are all asphalt. Joints that are mostly felt cannot have the efficiency of the Genasco joint and do not adhere to the brick or concrete. The Genasco joint is made in strips 5 ft. long; any width and depth desired. Send for sample.

A STRIKING ILLUSTRATION

Steel without Copper (black—uncoated) Same Steel with Copper (black—uncoated)

of the Durability of

KEYSTONE COPPER BEARING STEEL SHEETS

These illustrations show the actual result of exposure to the weather.

Keystone Quality furnished either in Black or Galvanized Sheets.

Send for booklet giving other photographic illustrations and details of tests. You will find it very interesting.

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Sewers and Culverts

properly built of properly made

Reinforced Concrete Pipe

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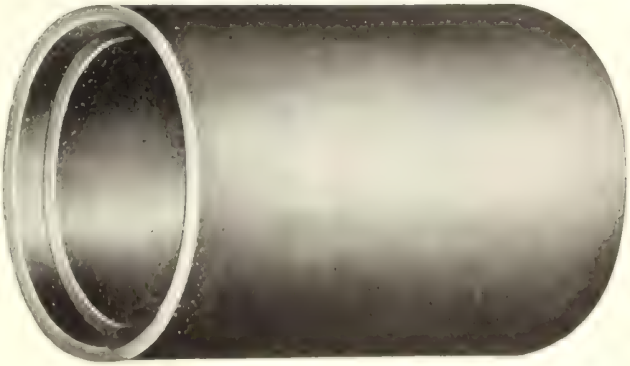

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

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ROMAN STONE

IS GOOD STONE

The Graphic Arts Building, Toronto. Built of Roman Stone
S. H. Baker, Archt.

The fine and uniform texture of Roman Stone obtained by pouring in Sand Moulds allows it to be tooled and carved like natural stone.

Roman Stone is ideal for every class of building. It was used to finish thirty-four branch banks for The Canadian Bank of Commerce.

The above building is a striking example of the possibilities of Roman Stone.

THE ROMAN STONE CO., LIMITED
1060 Yonge Street
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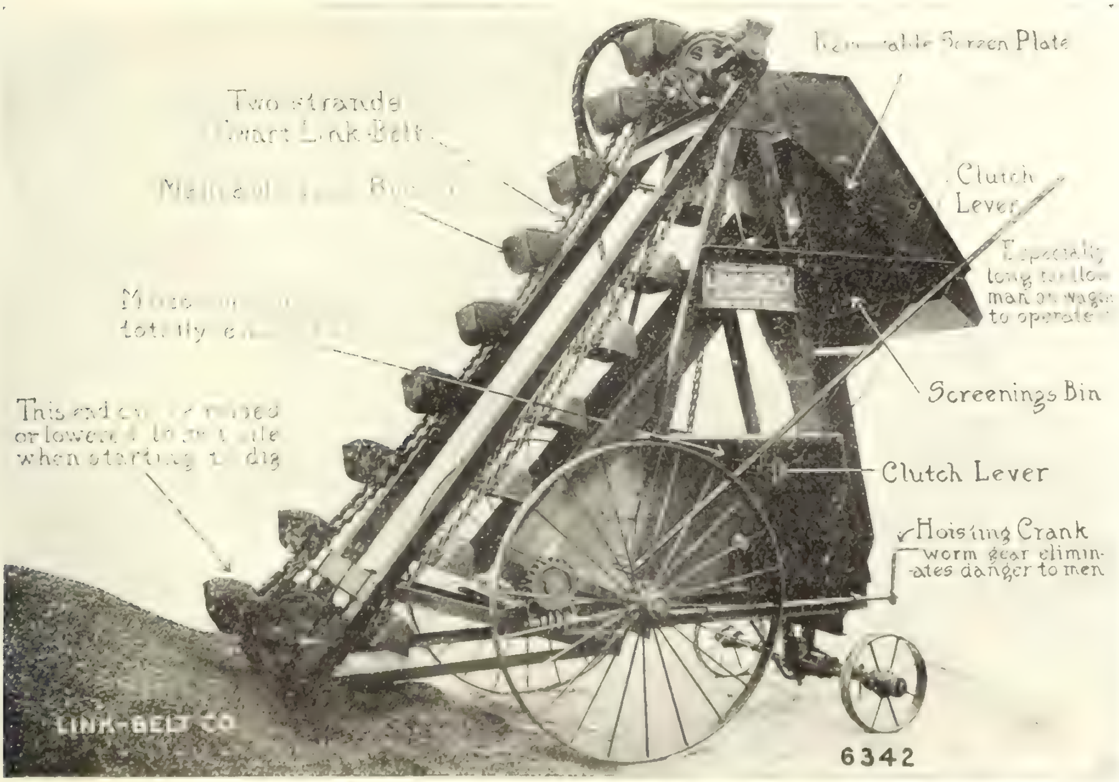
Link-Belt Wagon Loaders at Low Prices

Handle, Stone, Sand, Gravel and all loose materials


Removable Screen Plate
Two strands
Clutch Lever
Especially long to allow man on wagon to operate
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This end can be raised or lowered to meet pile when starting to dig
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Hoisting Crank worm gear eliminates danger to men
LINK-BELT CO
6342

This Standard Model "D" Loader will successfully handle all grades of coal Bituminous, Anthracite Run-of-Mine at the rate of 60 tons an hour. Gasoline or Electric Motor Driven—Hand-propelled or Self-propelling all modern improvements.

The great demand for Link-Belt Portable Wagon and Truck Loaders has enabled us to standardize our machinery and build these machines in larger quantities than ever before, and we are giving the trade the benefit of the reduction in cost of manufacturing which we have been able to make. The lower prices take effect immediately.

Every dealer who carries coal on ground storage will now find it to his interest to investigate at least the Wagon Loader Method of handling coal. Return the coupon to day.

The past three years have demonstrated the efficiency of the Portable Loading Machines. They are in successful operation today from coast to coast handling bituminous, run-of-mine, anthracite, stone, sand, gravel, clinker, and similar loose materials quicker and cheaper than by any other low-cost method.

With the Link-Belt Loader you can load a ton of coal per minute—or a 5-ton truck in less than five minutes. You can readily figure out yourself what this would mean in your own work.

WE ALSO DESIGN AND BUILD: **Car Unloaders portable or stationary, Locomotive Cranes with grab bucket, pile driver, or any modern attachment Coal and Ashes Conveyors for power houses, Elevating, Conveying and Power Transmission Machinery**

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LINK-BELT COMPANY
Nicetown, Philadelphia, Pa.

Without obligation you may send us Booklet, Revised Prices and information regarding the Link-Belt Portable Wagon Loader. We handle about tons of a day from ground storage to

Name
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Town and State

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TOXEMENT

The Up-to-Date Method of Waterproofing as Recognized by the Leading Architects and Engineers of the World

Gooderham Fountain—Canadian National Exhibition. Basin of fountain waterproofed with "TOXEMENT."

"TOXEMENT" is specially adapted and recommended for waterproofing concrete construction of dwellings, factories, loft and office buildings. Also for stucco surfaces of dwellings and buildings. "TOXEMENT" adapts itself especially for use in moulded cement work, such as urns, balustrades, benches, statues, garden furniture, walks, posts, fences, fountains, bridges, silos, dams, piers and walls. In moulded work "TOXEMENT" not only waterproofs but lubricates the mass, so that a denser body is produced.

"TOXEMENT" has been extensively used by tile setters in their cement grout because it makes a firmer bond between the tile and the concrete surface against which the tile is laid. On porches, piazzas and exposed surfaces, where a firmer bond between the tile and the construction concrete is necessary "TOXEMENT" has given excellent service, not only for bonding but waterpoofing.

Architects, engineers, builders and owners are invited to consult freely with us on problems that confront them on the waterproofing of cement construction.

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"COVERT IMPROVED"
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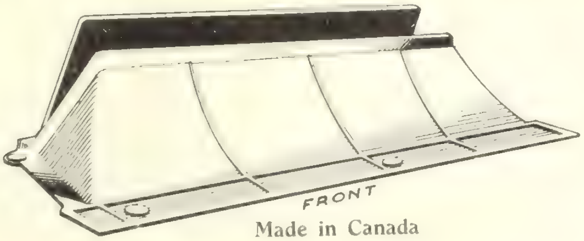
(PATENTED)

" The damper that makes possible a smokeless fireplace."



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Twelve Good Reasons Why YOU Should Use the "COVERT" DAMPER !

1. Prevents fireplace from smoking.
2. Throat and damper combined.
3. Forms lintel to support brickwork.
4. Presents smooth surface to lead smoke and gases into flue.
5. Simplifies mason's work and saves costly time.
6. Provides valve to regulate draft and ventilation.
7. Ensures a properly proportioned fireplace.
8. Simply and strongly constructed.
9. Cannot get out of order.
10. No complicated regulating gear or worm, nor piercing of brickwork necessary to operate same.
11. Prevents down-draft in summer from blowing soot into room.
12. Valve plate can be readily removed, should flue become clogged through falling brick or mortar, or from other cause.

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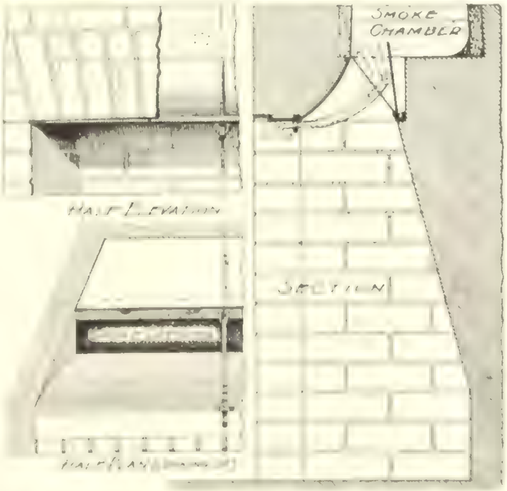

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Manufactured and Sold by

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Standard Clay Products

No. 1 Plant at St. John, N. B.

Front view—Plant No. 3, New Glasgow, N.S.

Sewer and Culvert Pipes

Hollow Building Blocks

The Standard Clay Products include salt glazed vitrified sewer pipes. Culvert pipe and sewer pipe connections of all descriptions, hollow building blocks, chimney tops, inverts, vases and all kinds of vitrified and fine clay ware.

Our plants are situated in localities abounding in ideal raw material for our products. Plant No. 3 at New Glasgow is the latest addition to our facilities and is equipped with the very newest clay working machinery.

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Three Sewer Pipe Factories: **St. Johns, P. Q., and New Glasgow, N. S.**

Also Fire Clay Factory at St. Johns, P. Q.

A NOTED TRIO

The three quality brands of burned clay products — "Scotia", "Beaver" and "Acadia" are made at our three plants in Nova Scotia.

These factories are located in an environment of ideal conditions for the manufacture of clay products. The clay deposits are excellent and extensive and the shipping facilities unexcelled.

Price and particulars cheerfully furnished and prompt shipments guaranteed.

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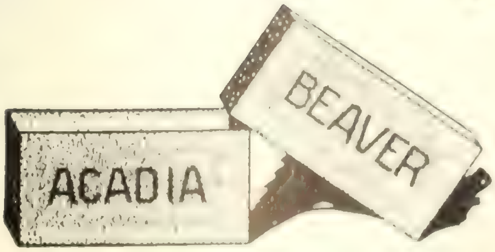
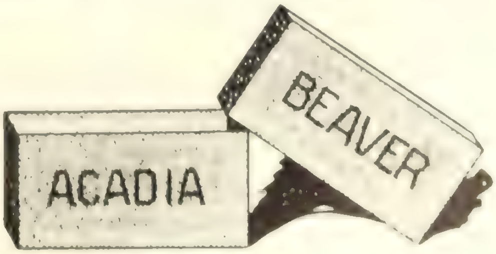
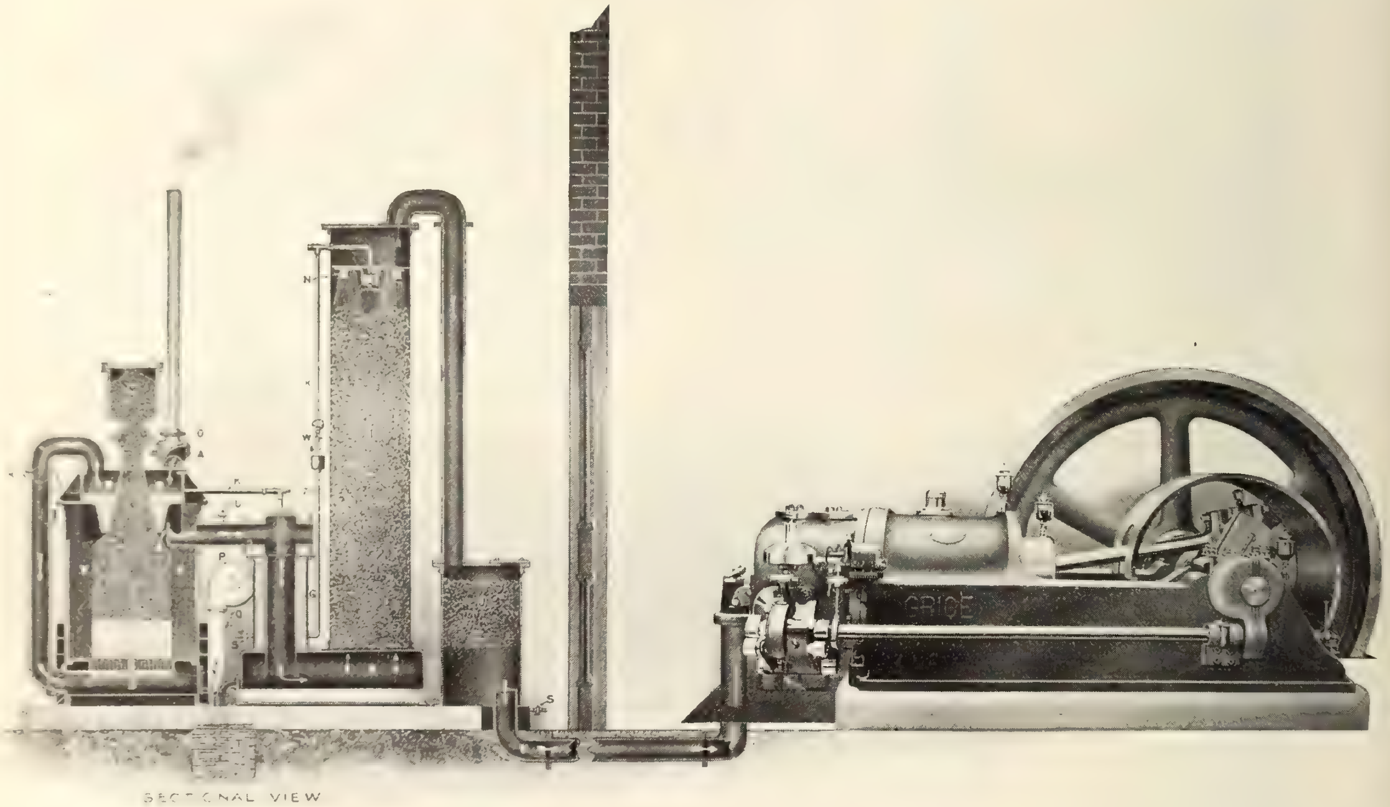




High-Class Gas Engines and Gas Producer Plants

FOR ANTHRACITE COAL, COKE OR CHARCOAL



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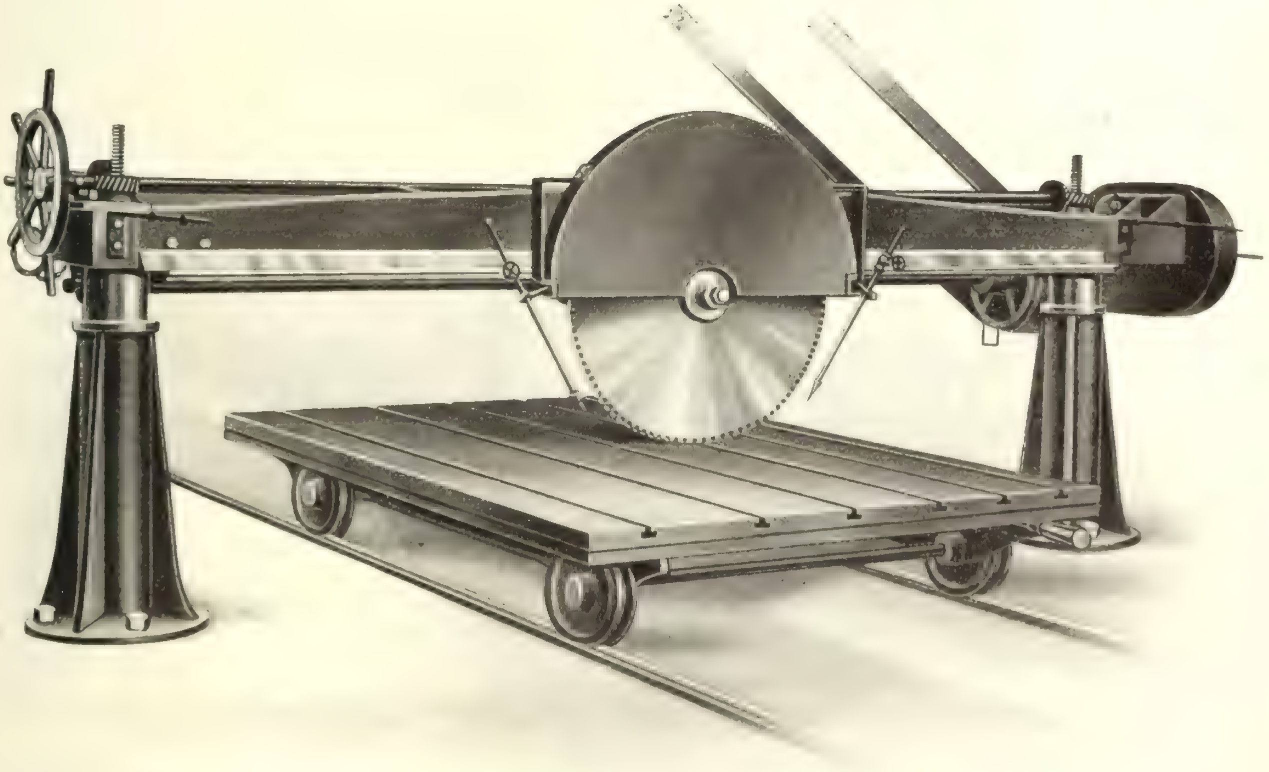

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Cutting and Coping Hexagons, Octagons and Squares
without removing stone from table

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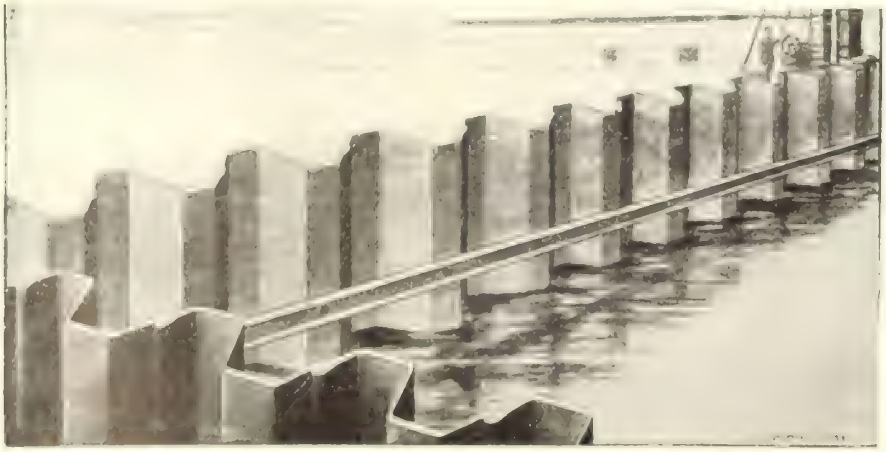

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positively will reduce finishing cost one half or more

WHY?

Why pay **three** men to do the work of **one**?

Why not save 75% of your labor cost for finishing work?

Why break your back and bruise your knees; do you like it?

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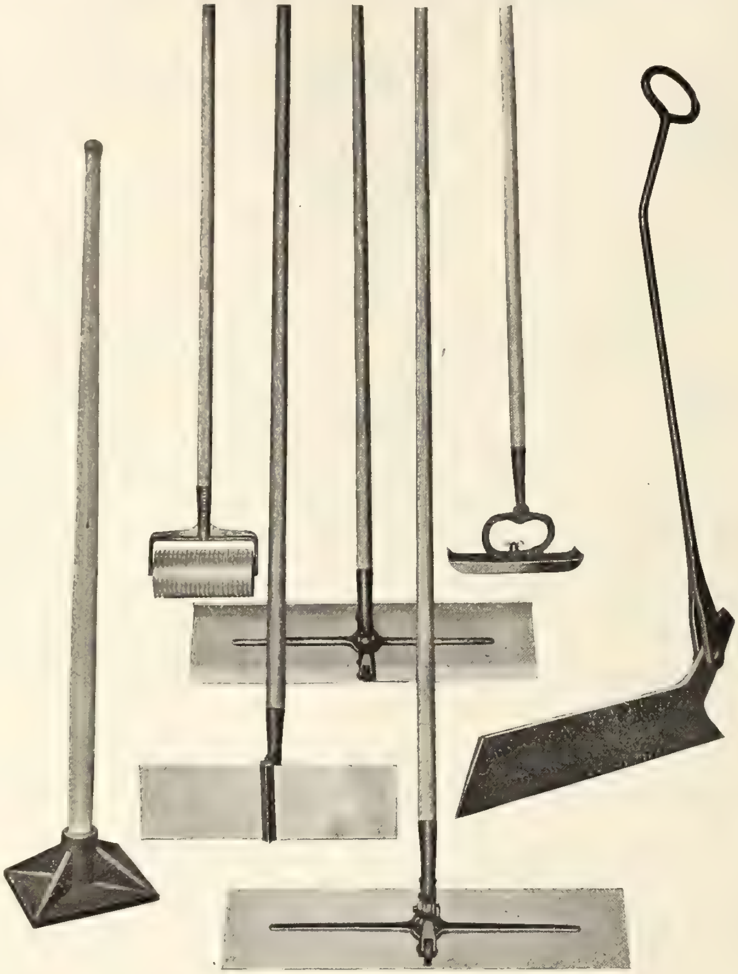
Why not write for our big general catalog to day? Others are doing it and saving money.



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We manufacture a general line of contractors equipment in addition to our famous long handled sidewalk finishing tools, and we can save you money on every item shown in our big general catalog, which is yours for the asking.

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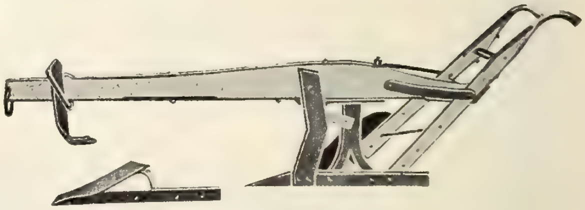
Is not the above picture suggestive of a big SAVING IN LABOR? With a set of these tools on your job, this Big Saving and Satisfaction would be yours.



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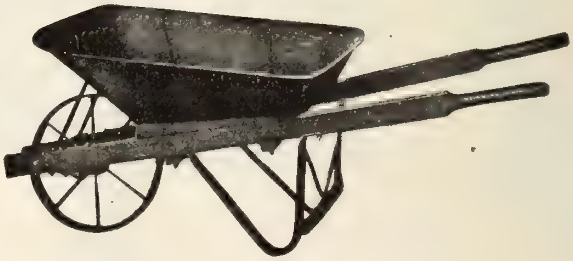

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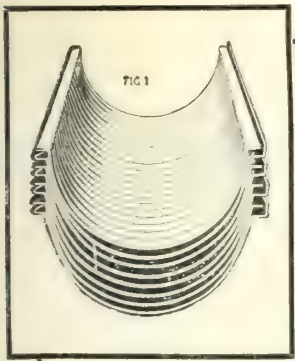

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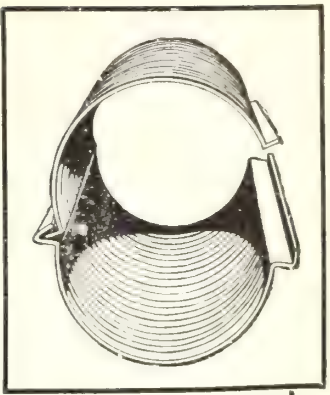

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Pedlar's "Perfect" Corrugated Nestable Culverts

They are made of heavy gauge, anti-corrosive "Toncan" Metal, and are 29 times as strong as a plain iron pipe of similar gauge.

The close nesting saves much in freight, and economy is effected by using them, as they can be stopped off at any section, every 2½ feet. Put together by one man on the job and transported on an ordinary spring wagon.

PEDLAR'S "PERFECT" RIVETTED CULVERT is in use by railways throughout Canada. Made of the same anti-corrosive, heavy gauge metal as the nestable type. Both culverts are unaffected by frost.

Write for complete Culvert Reference Book No. 4 C. R.

This gives drainage tables and full data as to sizes needed to handle flow of water.

The Pedlar People, Limited, Head Office and Works Oshawa, Ont.

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Advantages:—

Disinfectant, Washable, Durable, Economical, Fireproof and Artistic. Will not fade. Will not peel off. Will stand the effect of Lime. Seventy shades all one price. Made in two qualities for interior or exterior use on any surface.

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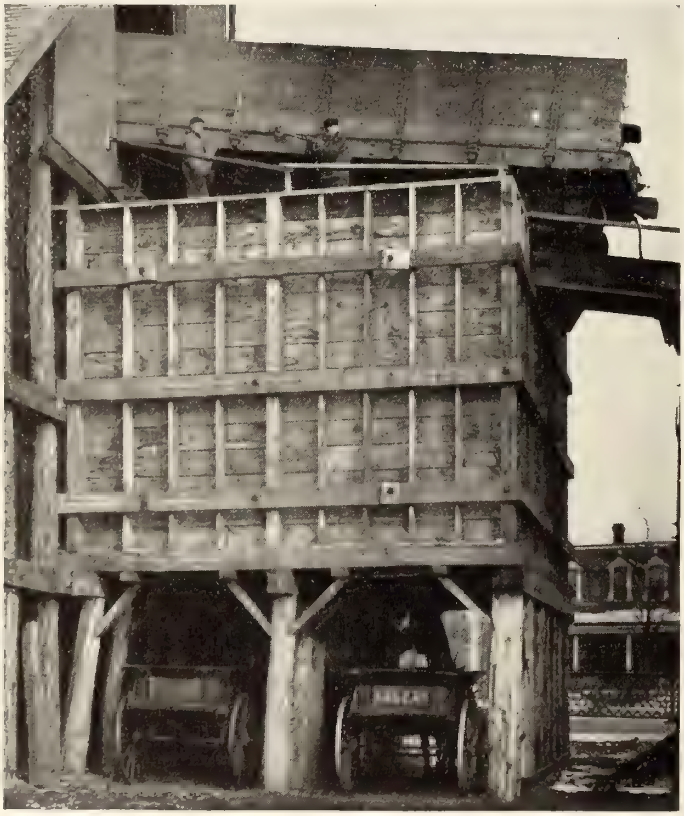

Stocks Carried at all Yards. Stone Clean and True to Size.
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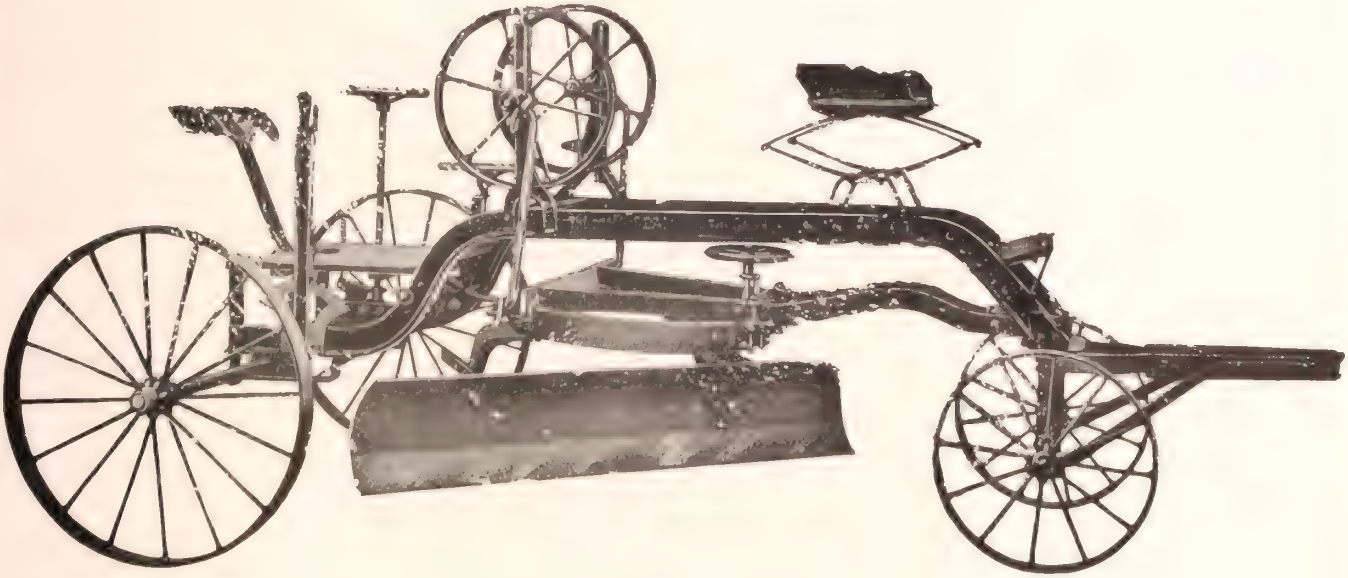
$30,000,000 for Good Roads In One Province

This is the recommendation brought before the Ontario Legislature. Great opportunities for Road Contractors all over Canada. To get best and quickest results see Dore & Fils for road machinery.

Ask us about them.



Our "IDEAL" Road Machine Owns the Following Features:-

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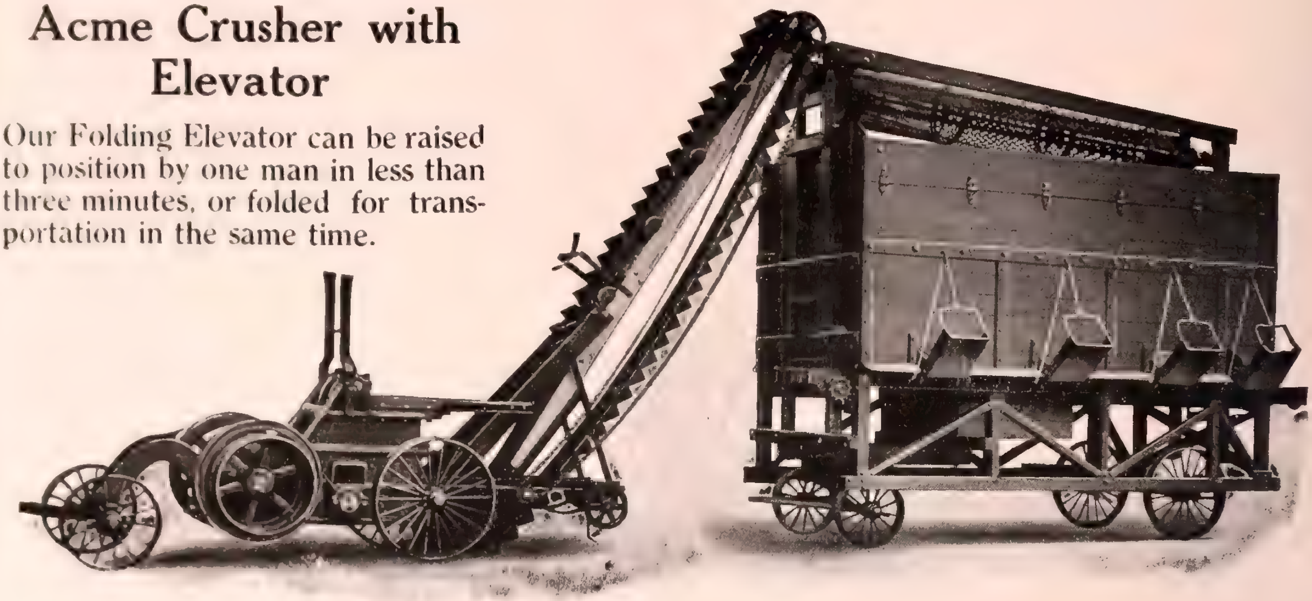
Acme Crusher with Elevator

Our Folding Elevator can be raised to position by one man in less than three minutes, or folded for transportation in the same time.



Right Roads!

Contractors! To get best results with maximum profit, use our road machinery.

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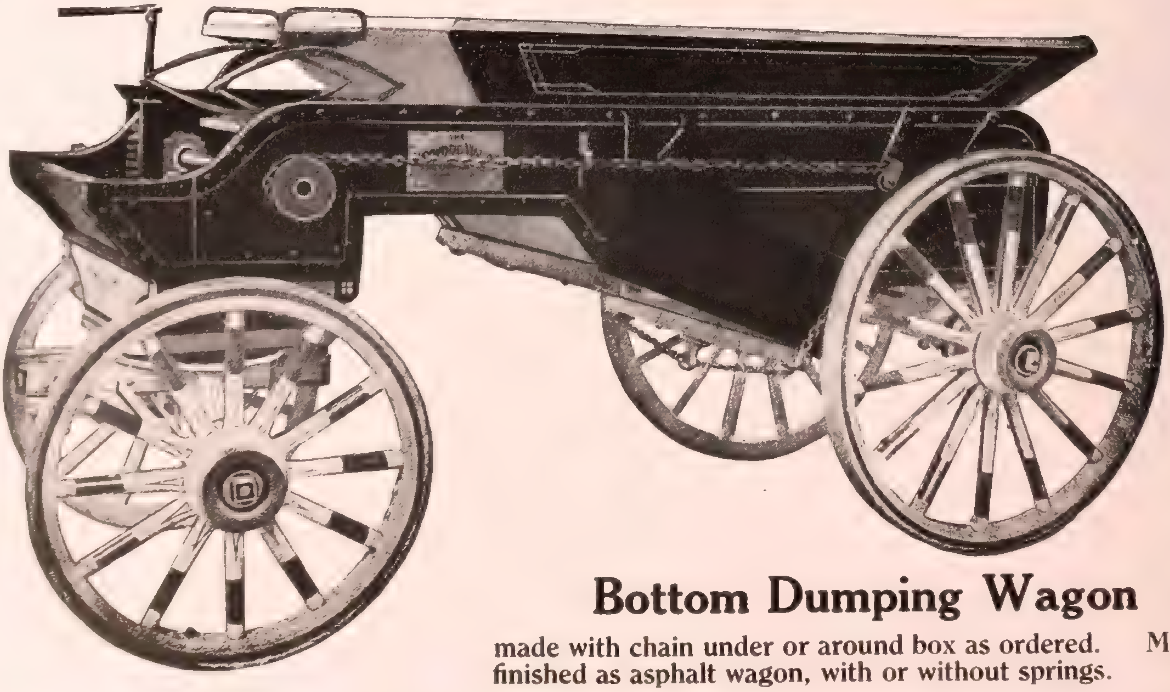

Bottom Dumping Wagon

made with chain under or around box as ordered. May be finished as asphalt wagon, with or without springs.

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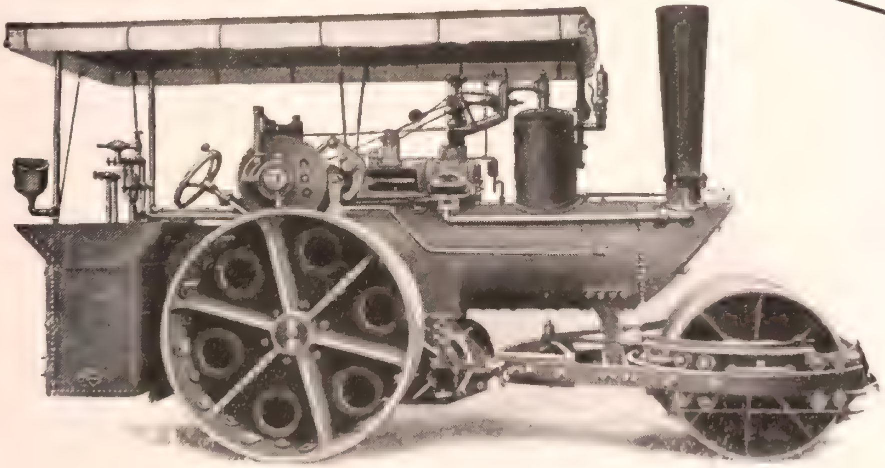

For Road Machinery see

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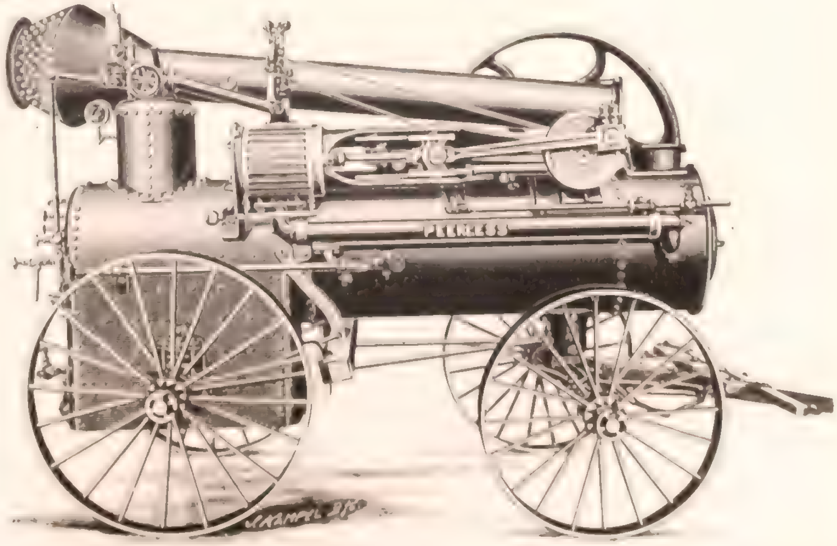
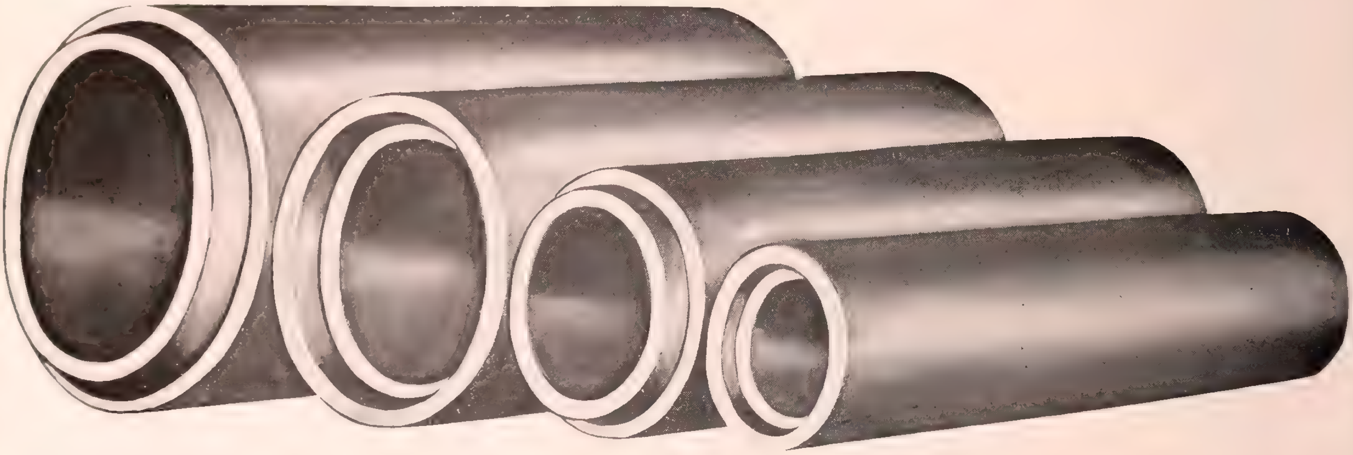


The Roman Roads of Old

Can we equal them?
YES with correct methods and our
Road Machinery.
J. B. Dore & Fils



We Make Concrete Pipes for all Purposes

Many municipalities are using large quantities of our specially reinforced sewer and culvert pipe. We make them to any specifications. Let us know when you contemplate any work and we will quote you prices, it may save you **money and trouble.**

If it is to be Cast Iron Pipes

Our "IDEAL" Cast Iron Culvert Pipes prove to be more durable than any other kind. Cast iron pipes have been found in good order after having been two hundred and fifty years in use. We carry "Ideal" Cast Iron Pipe in stock.

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The Dump Car of To-day

is put to such rigid tests during the various operations in which it is employed, that attention to detail during every process of manufacture must be strictly observed. Competition in this line of contracting equipment desolves itself into the survival of the fittest.

Bechtel Cars

and satisfaction are synonymous.

Bechtel Steel Dump Cars are in constant service in brickyards, contracting work, sand pits and mines throughout Canada, and their selection in every case has been fully justified by their consistent good work.

Bechtel Cars embody

Simplicity and Strength

the two features demanded of Dump Cars by every contract.

Your inquiries are solicited.

Bechtels Limited, Waterloo, Ontario

Use Pure Gypsum Plaster

IT WILL SAVE YOU MANY DOLLARS

IONA white wall finish is uniform in color, quality and setting speed. The use of this plaster will speed up the work of your plasterers and therefore reduce your cost on a job.

Iona pure hard wall plaster is the most satisfactory material for plastering work because it sets as hard as a rock and never cracks, scales or falls.

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The Iona Gypsum
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For Permanent Lines:

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30″ Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

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PREVENTS ACCIDENTS AND ENABLES EMPLOYEES TO DO MORE AND BETTER WORK.

Big "EMPIRE LAMPS" may be RENTED by the DAY, including Oil, Mantles and Attendance; by the MONTH, without Supplies, or may be PURCHASED outright.

N. B. The fact that on PRACTICALLY every large building erected in Montreal during the past three years, "THE EMPIRE LIGHT" has been used is, in itself, a sufficient recommendation.

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Burns Coal Oil

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Crown Office Building **Toronto, Ont.**

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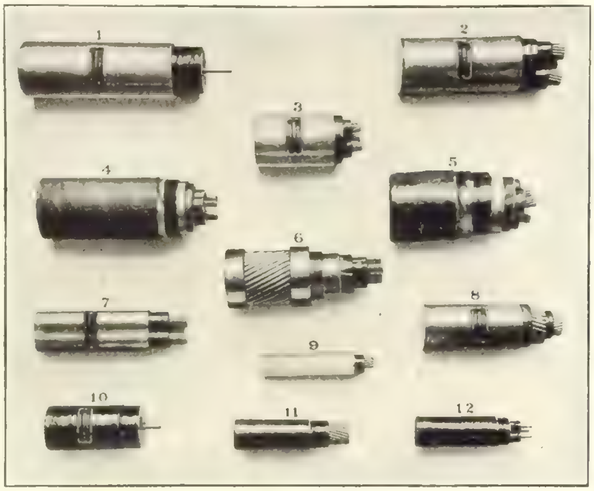

1, 2—Varnished Insulated Lead-Covered Cable.
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Our Argument

when thus soliciting your patronage for our products is based principally on these three facts:

First, the superior and sustained quality of Standard products;

Second, their great variety which enables us to meet your every requirement in the way of electric wires and cables and their accessories;

Third, our extensive and up-to-date facilities which enable us to meet your emergency demands, shipping promptly from extensive stocks all products not necessarily made to special order.

The following is an outline of our principal products:

Wire Rods
Bare Wire and Cable
  Trolley, Line and Transmission Wires
Standard C.C.C. Wire
  (Colonial Copper Clad)
  Bare and Insulated
Magnet Wire
  All sizes shapes and finishes
Weatherproof Wire
  All types and finishes
Rubber Insulated Wire
  For all kinds of service
Varnished Cloth Cable
  Braided or Lead-Covered
Fibre Lead-Covered Cable
  Telephone and Telegraph Service

Paper Lead-Covered Cable
  Dry or Saturated Cores
Rubber Lead-Covered Cable
  For all kinds of service
Armored Cable
  Steel-Wire and Steel Tape Armored
Cable Terminals
  (D. O. A.) Outdoor
  (D. S.) Indoor Service
Cable Junction Boxes
  For A. C. or D. C. Systems
"Ozite" Insulating Compounds
  For Joints Terminals, Junction Boxes
InsulatingTapesand Sheets
Jointing Supplies
Cable Hangers and Supports

Cable Installations

Detailed information, samples, estimates or prices of any of the above products will be cheerfully and promptly supplied upon request to our nearest office.

Standard Underground Cable Co., of Canada, Limited
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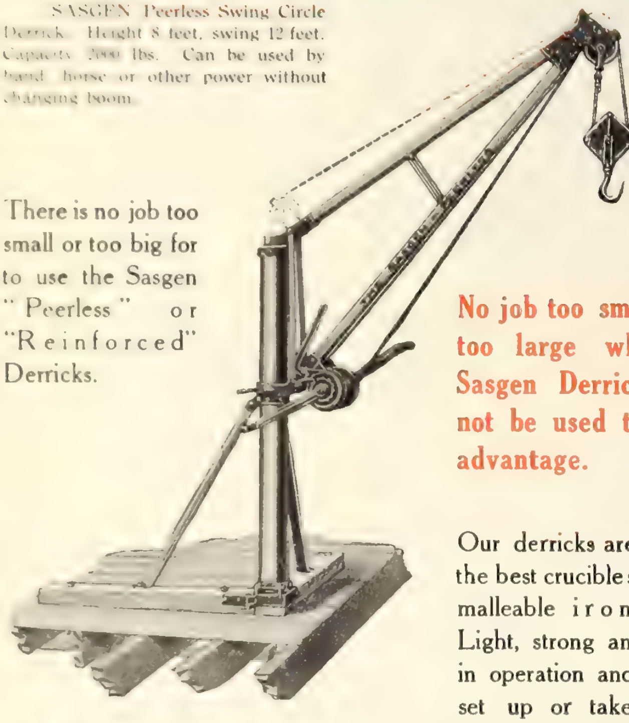
Montreal, Que.   Boston, Mass.   Seattle, Wash.   Winnipeg, Man.

THE SASGEN DERRICK COMPANY

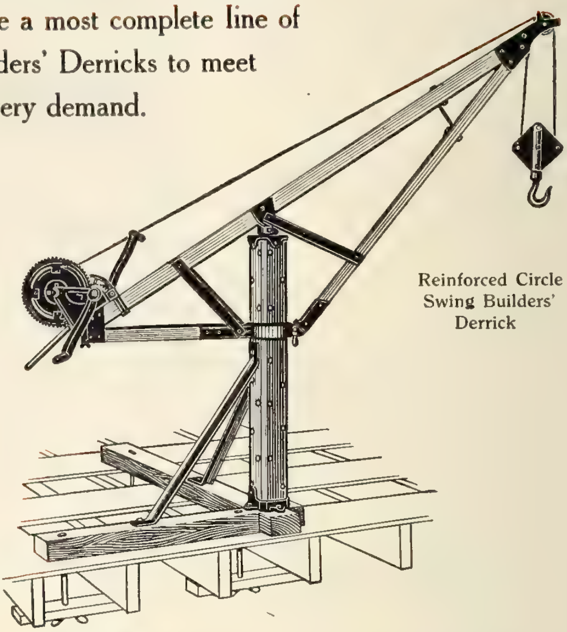
1 Wabash Ave., Toronto, Ontario

SASGEN Peerless Swing Circle Derrick. Height 8 feet, swing 12 feet. Capacity 2000 lbs. Can be used by hand, horse or other power without changing boom.



There is no job too small or too big for to use the Sasgen "Peerless" or "Reinforced" Derricks.

We have a most complete line of Builders' Derricks to meet every demand.

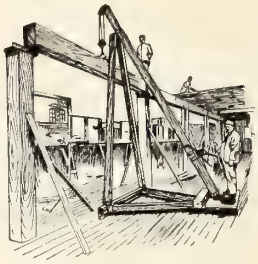


Reinforced Circle Swing Builders' Derrick

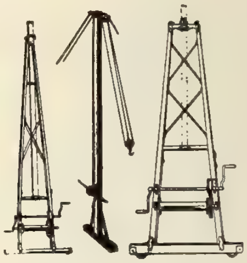
No job too small, nor too large where a Sasgen Derrick cannot be used to your advantage.

Our derricks are built of the best crucible steel and malleable iron fittings. Light, strong and quick in operation and easy to set up or take down. They save money, time and labor.

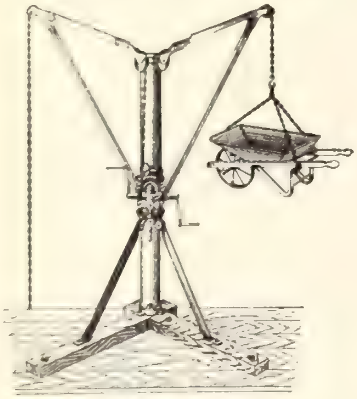
To a reliable customer we shall be pleased to send any derrick on a three days trial.



"A" Frame Builders' Derrick



Setter Derricks

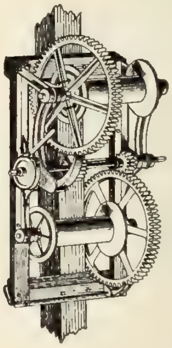


Circle Swing Double Boom Wheelbarrow Derrick

Our motto is "SATISFACTION OR NO SALE" and we can guarantee prompt delivery.

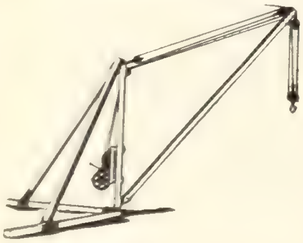
Write for Circular "R"

Your enquiries will have our prompt attention.

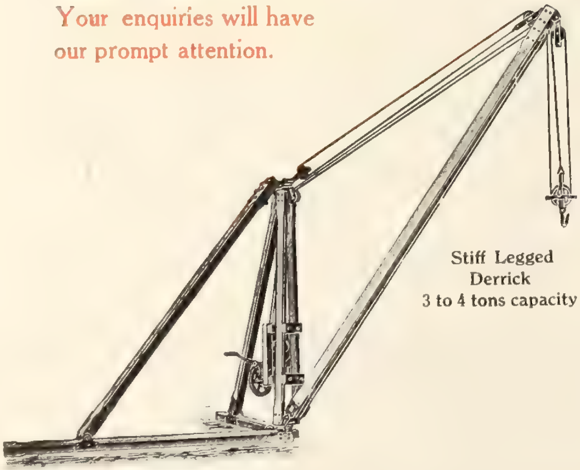


Drum Geared Winch

Our Single and Double Drum Geared Winches are made of crucible and malleable steel.



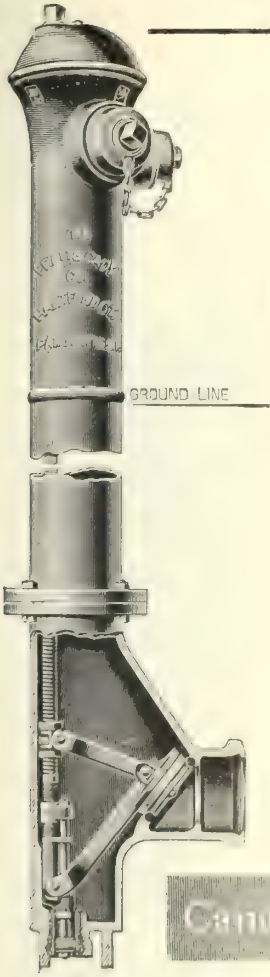
1 and 2 ton Derrick



Stiff Legged Derrick
3 to 4 tons capacity

We also manufacture Stone Grab Hooks, Timber Tongs and Timber Dollies.

Our Stiff Leg and Scotch Derricks are built from Crucible and Malleable fittings throughout.



Don't Buy Hydrants by the Pound

See that you get a hydrant which comes the nearest to eliminating all loss of pressure between the hose and the main.

Pratt and Cady Hydrants

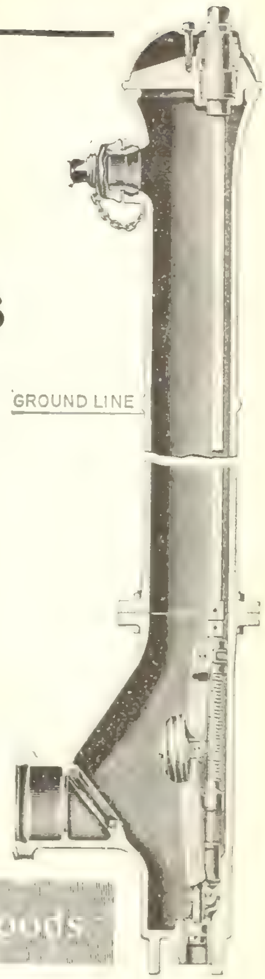
Have a free waterway from the main to the hose coupling, and will deliver a solid stream of water to the hose, operating rod is located on one side and the valve is raised out of the way when the hydrant is opened.

Absolutely self-draining when properly installed, there is no necessity for frost cases.

You owe it to your taxpayers or stockholders to investigate the merits of the Pratt & Cady hydrants before placing your order.

Write now for full information.

Fairbank's "Double Parallel Disc" gate valves for water works will appeal to all discerning buyers.



The Canadian Fairbanks-Morse Co., Limited

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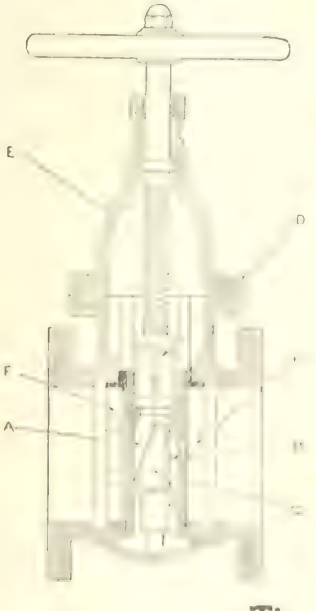
Canada's Departmental House for Mechanical Goods

Fairbanks Water Works Valves

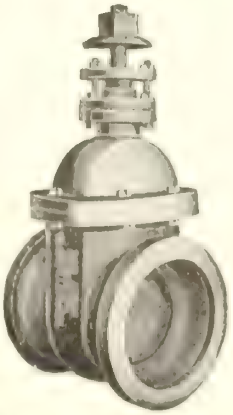


Fairbanks Double Disc Iron Body Gate Valves are particularly adapted to water-works installations.

The illustrations present [illegible] and compact design without a clumsy appearance, and offers unique advantages for the renewal of parts with minimum trouble and expense. Ease of operation and absolute freedom from danger of the wedge becoming stuck are valuable features, and the elimination of friction between the bearing surfaces of the wedge faces and seat rings materially increases the durability of these Valves.

The Valve mechanism is a double Gate, simple in construction, and all wearing parts are fully brass mounted.

We are prepared to quote on valves, pipe and fittings for your complete installation and will gladly do so on receipt of blue prints and specifications.



[illegible]
Hub End Gate Valves
Hydrants Valve Boxes
Hydraulic Flange Fittings
Flap Check Valves

The Canadian Fairbanks-Morse Co., Limited

Montreal Toronto
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Winnipeg Calgary
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Victoria

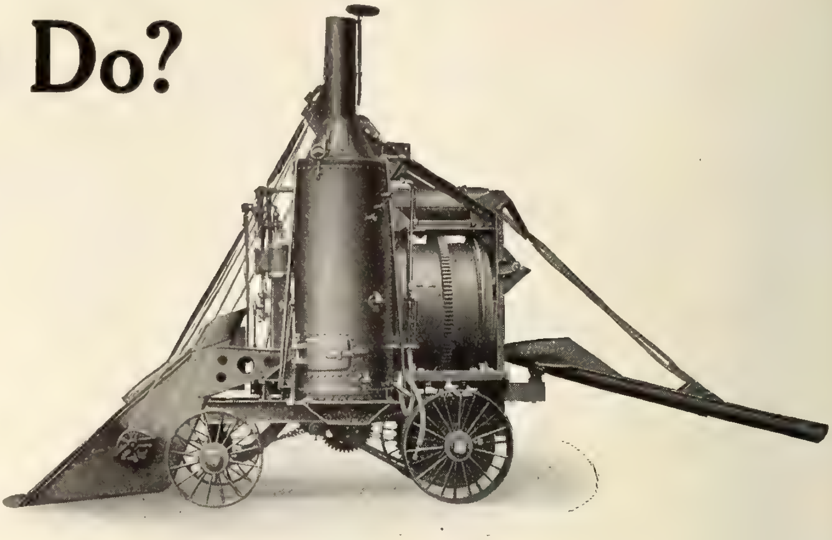
Canada's Departmental House for Mechanical Goods

What Will It Do?

In buying a concrete road or street paver the above question is paramount. Other pavers have **perhaps some** of the important features found in

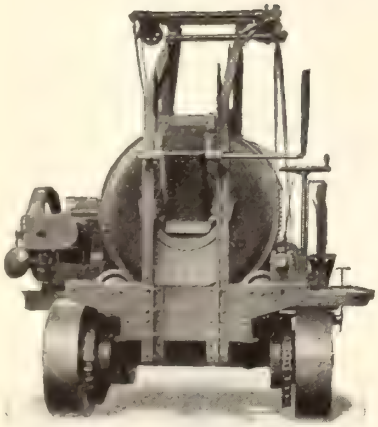
M-C Rail-Track Pavers

but no other machine on the market today has all, or nearly all, of the good points of these machines. See them at work—compare them with others—then you will understand why we are so positive in our claims.



M-C Rail-Track Paver fitted with 10 h.p. Steam Engine and 12 h.p. boiler fitted with Delivery Chute

M-C Rail-Track Pavers



M-C Rail-Track Paver fitted with 12 h.p. Gasoline Engine, arranged to discharge into two-wheeled carts.

have gained the distinction from biggest contractors and expert mechanical engineers of being world beaters. Note what an M-C Paver will do:

It will discharge into carts when machine is set up at intersection of city streets.

When fitted with **delivery chute**, it will most economically lay concrete for roads or narrow streets.

When fitted with **delivery boom,** with mixing conveyor, it can't be excelled for laying base for wide pavements.

Working on the **low gear** when traveling, it will pull itself out of trouble on bad roads, or climb hills in a way that is impossible with a machine that is higher geared, or has less power.

When travelling on the **high gear** it will make better time in going from job to job than is possible with lower geared machines.

Because of the brakes, it is always under control when going down hill.

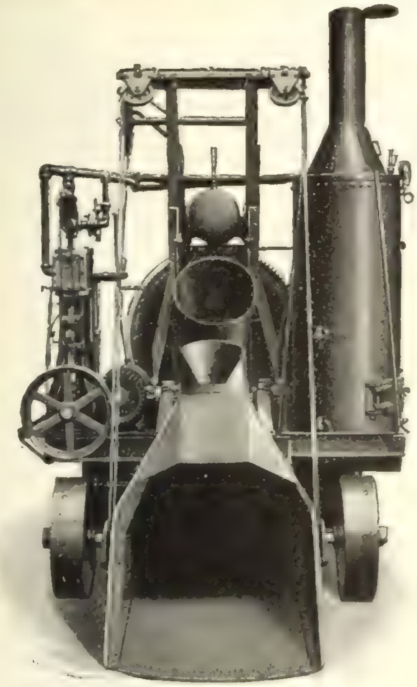
It will mix a two-bag batch of 1-3-5 concrete without spilling.

Write for Special Bulletin describing the Paver in full—Free

CANADIAN FAIRBANKS-MORSE CO., Limited

MONTREAL ST. JOHN OTTAWA TORONTO HAMILTON VICTORIA VANCOUVER

Manufactured by **Marsh-Capron Mfg. Company** 465 Old Colony Bldg.
CHICAGO



M-C Rail-Track Paver with Steam Power, Showing Pivoted End Hoist

Here's the Paver for You!

THE M-C Rail-Track Paver is backed by M-C reputation. Every claim made for it is made in absolute sincerity by the manufacturers. Note the construction of an M-C Paver.

Extra Large Capacity—11 cubic feet of mixed concrete, 2-bag batch 1-3-5.

Surplus Power—10 h.p. Steam Engine with 12 h.p. Boiler or 12 h.p. 2-cylinder gasoline engine.

Two Traction Speeds—½ and 1¾ miles per hour ahead. 1 mile per hour reverse.

Extra Large Wheels—Rear, 36″ diameter by 10″ face. Front, 30″ diameter by 10″ face.

For Narrow Roads—A simple 8 ft. chute for spreading on narrow roads.

For Wide Streets—A remarkable 16 ft. boom for spreading on wide streets. This boom gives the concrete an extra mix, delivering anywhere between the mixer and the end of the boom.

Other Features—An efficient set of brakes—a powerful differential gear—perfect one-man control—high discharge for dumping into carts—all weight carried very low so machine can't overturn.

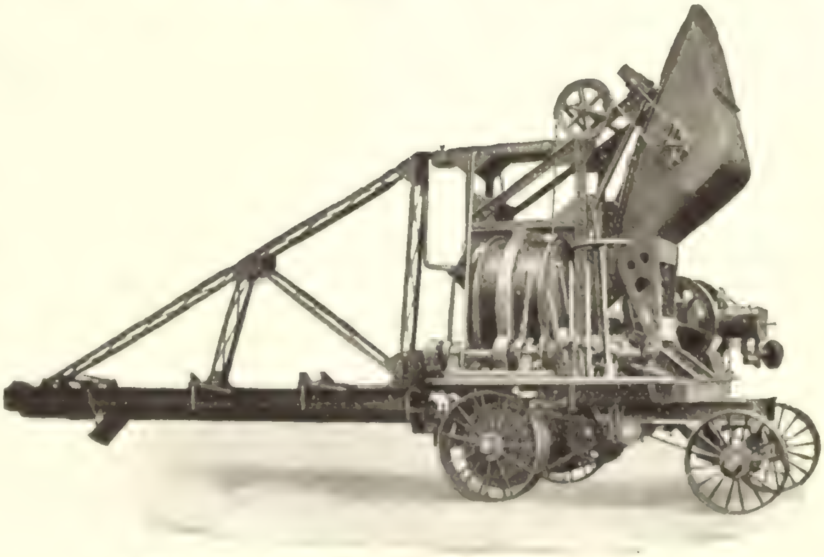
M-C Rail-Track Pavers

M-C Rail-Track Pavers have all the good features found in other street or road paving machines.

And many that the others have not.

That's why big contractors and machinery experts—men who give careful thought to road and street concrete paving mixers the country over, insist upon M-C equipment, which means

"Most Mixing Least Fixing."



M-C Rail-Track Paver with Gasoline Engine, showing Delivery Boom

Send to nearest agent for full information

CANADIAN FAIRBANKS-MORSE CO., Limited

MONTREAL ST. JOHN OTTAWA TORONTO HAMILTON VICTORIA VANCOUVER

Manufactured by **Marsh-Capron Mfg. Company** 465 Old Colony Bldg.
CHICAGO

AN OLD STORY

Told a New Way

THIS story will not be new to our friends who have visited our Quarries, Mills and Shops, but to those of you who have not (hope you will at the first opportunity), we want to send you a message of facts.

You all know what "Missisquoi" marble is—many of you have seen it in the better buildings in Canada and we all concede that "Missisquoi" really has all the necessary qualities when finished to give warm, harmonius and attractive effects.

Has "Missisquoi" come to stay? YES. We have millions of cubic feet—acres of it. Our Quarry equipment consists of all the latest improved types of machines. The same is true of our Mill and Finishing Shops.

In our Sales Department a corps of experts are ready to figure with you and assist in designing and producing attractive color schemes. Prices have been reduced to give all the opportunity of using it.

Our Quarries and Mills are running day and night—hundreds of blocks are on hand and thousands of square feet of sawn stock await your orders.

PARLIAMENT BUILDING, EDMONTON, ALTA.—MISSISQUOI MARBLE USED THROUGHOUT.

MISSISQUOI-LAUTZ CORP'N LIMITED

Head Office, Quarries, Mills, Shops **PHILIPSBURG, QUEBEC**

Branch Offices—Montreal, Toronto, Winnipeg, Calgary, Vancouver, New York City

Put Your Factory Equipment Needs Up to

GOODYEAR
TORONTO

Goodyear factory equipment has established a new efficiency standard in large and small manufacturing concerns throughout the Dominion.

Where "price" used to be the basis of purchase in these places, it is now *SERVICE.*

Belting now is bought on *service rendered* and *operating economy effected.* So is Hose. So are Packing and Valves. Manufacturers are buying Goodyear equipment because they know that they can get the very article for the very need—based on an actual investigation and study of the very requirement.

And in buying factory equipment this Goodyear *efficiency service* is yours without extra charge.

Belting

Transmission Belts that deliver all the power without undue strain on the pulleys and "coal pile." Each belt made to meet the very purpose for which it is designed. Each made for "pulling" power—without unnecessary bulk and weight.

"Leg" and "Bucket" Conveyor Belts. For carrying heaviest loads—coal, gravel, ore, grain, etc. Each made with the exact surface for the exact purpose. Carry the load with least wear and tear. Day in and day out utility insures real economy.

Special Brick Conveyor Belt—with oil-resisting stock face. Unaffected by oil that is shed by machine.

Tell Goodyear your belt needs. Learn beforehand of just the belt, *and why.* Then, no after regrets—no after expense.

Hose

Steam Hose, Air Drill Hose, Agricultural Hose, Hose for gas, acids, and hot and cold liquids. Each made with the special inner lining for its particular purpose. Hence, longer life—*greater service.*

Let Goodyear tell you of just the hose you need. Perhaps you have not thought much about it before. But it's a vital matter just the same, if you value time and money saving. Goodyear has already solved just such hose problems as yours.

Packing and Valves

Poor packing may serve today—and tomorrow. But it soon gives out. That means lost time—lost motion—expense.

Goodyear Packing gives you a tight joint whether the pressure is air, hot or cold water, or superheated steam. Will not blow out. Unaffected by expansion or contraction. Won't flow under intense heat or pressure.

Goodyear Valves are made for all purposes—from cold water to acids—low pressure and high pressure, air and steam. We will tell you the "why" of just the Goodyear packing and valves for your every purpose.

Use This Free Service Asking questions about your belting, hose, packing and valve needs, costs you nothing—involves no obligation. The Goodyear Efficiency Bureau will be glad to confer with you at any time. Write today.

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Head Office: Toronto, Ont. **Factory: Bowmanville, Ont.**

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LIMITED

(Formerly Canada Steel Co., Ltd.)

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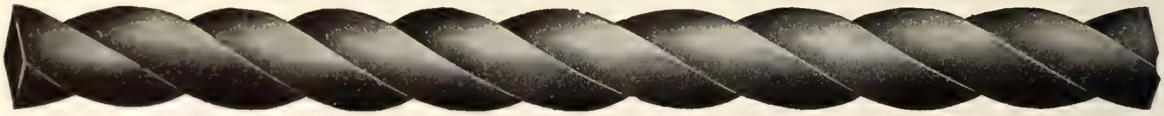

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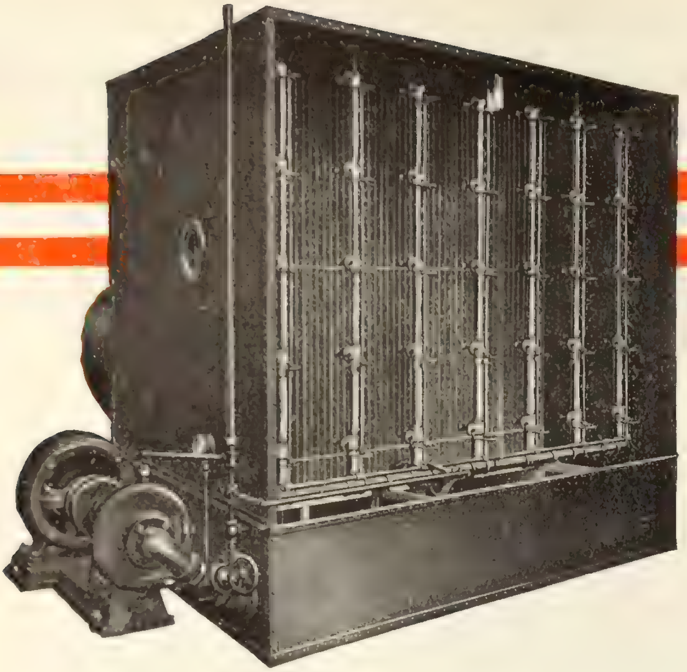

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System of Purifying—Cooling and Humidifying

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That is why Builders and Owners of modern Industrial plants consider ventilation as a prime factor.

We want you to thoroughly investigate the Sirocco System *because* it provides for a *definite* degree of ventilation *at all seasons.*

The air is washed clean of all impurities; producing a healthful and invigorating atmosphere indoors, *regardless of outside conditions.*

In Winter the Sirocco System provides for pure fresh air *warmed* to a comfortable and workable degree.

In Summer pure fresh air is introduced into your workrooms considerably *cooler* than the temperature outside.

With this system these conditions are always *uniform* throughout the entire plant.

Have you analyzed the condition of your plant? Let us investigate for you and cooperate with your Architect and Engineer, in the proper application of a Sirocco System for your needs.

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1914 Attainments

New premises, with an installation of up-to-date plant for the manufacture of First Class Mirrors and Art Glass.

Price lists of Plate, Sheet and Fancy Glass furnished on application.

Your inquiries for all kind of Glass Work are solicited.

Quotations from specifications by return.

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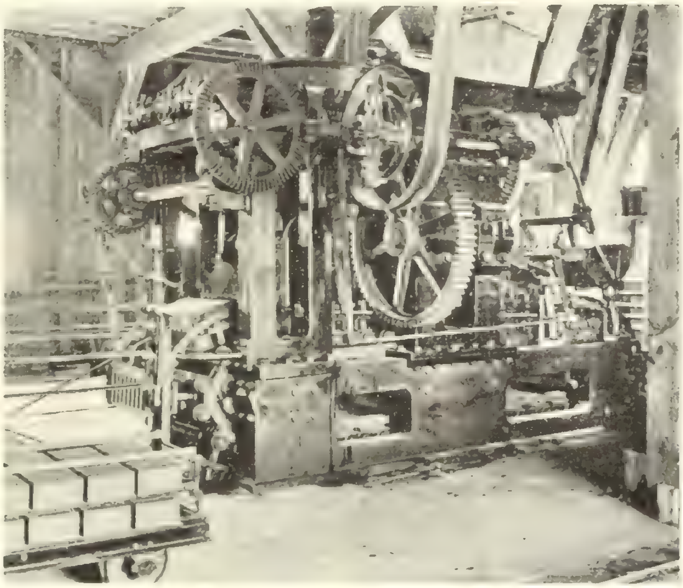
PROMPT ***DELIVERY***

HIGHEST STANDARD

TELEPHONES CONNECTING ALL DEPARTMENTS — MAIN 365
MAIN 366

"WE STAND ALONE" "LET THEM ALL COME"

"WE STAND ALONE" "LET THEM ALL COME"



Enamel Face
Pressed Face
Moss Face

Any Shade
or Color

Enamel Concrete Brick

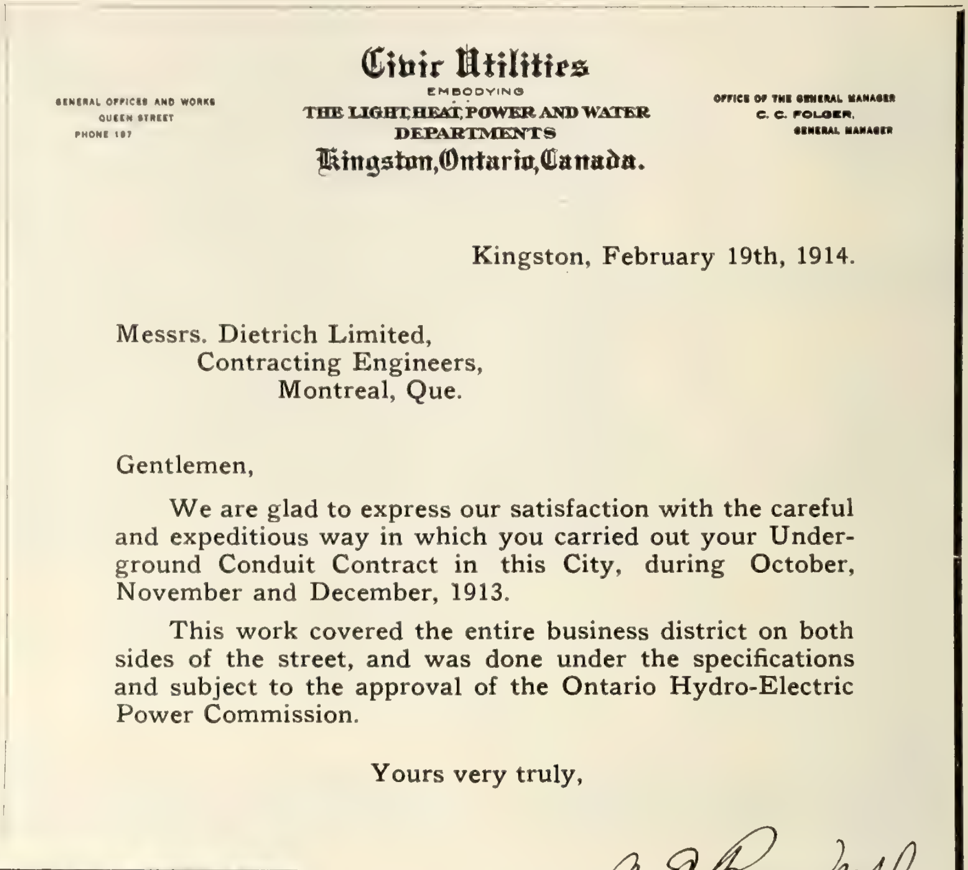
Produced at the rate of 35,000 per day at our new, perfectly-equipped plant at Mascouche, P. Q., which we invite ARCHITECTS, BUILDERS and CONTRACTORS to visit and see this brick in process of manufacture.

ENAMEL CONCRETE BRICK has been endorsed by many of the leading architects and engineers throughout Canada and the United States. It stands a greater test for STRENGTH and FIREPROOF QUALITIES than clay brick, and grows stronger with age.

The National Builders' Supply & Enamel Concrete Brick Co. Ltd.
MONTREAL

Our plant at Mascouche P.Q.

This is the letter



GENERAL OFFICES AND WORKS
QUEEN STREET
PHONE 197

Civic Utilities
EMBODYING
THE LIGHT, HEAT, POWER AND WATER
DEPARTMENTS
Kingston, Ontario, Canada.

OFFICE OF THE GENERAL MANAGER
C. C. FOLGER,
GENERAL MANAGER

Kingston, February 19th, 1914.

Messrs. Dietrich Limited,
Contracting Engineers,
Montreal, Que.

Gentlemen,

We are glad to express our satisfaction with the careful and expeditious way in which you carried out your Underground Conduit Contract in this City, during October, November and December, 1913.

This work covered the entire business district on both sides of the street, and was done under the specifications and subject to the approval of the Ontario Hydro-Electric Power Commission.

Yours very truly,

A E Ross M.D
Chairman.

C C Folger
Gen. Manager.

This is part of the job

This is the Firm

Dietrich
LIMITED

Contracting Engineers

300 Read Bldg.
Montreal

GOOD ROADS

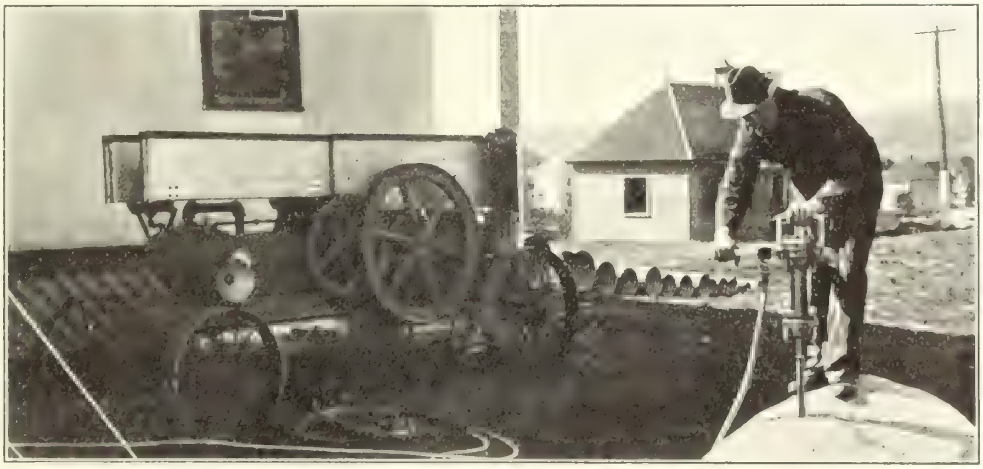
Ancient and Modern

The building of good roads has always been the sign of higher civilization and rapid industrial progress.

In the days of the Romans, roads were built so thoroughly that many of them exist to this day—nineteen hundred years after.

They were built by thousands of slaves superintended by soldiers. Years were spent in their construction and the work was well done.

In the present day slaves are not available; paid labor is necessary, and time is more valuable. Modern mechanical appliances have reduced the labor element and have greatly facilitated good road building.



A most convenient outfit is the

Portable Gasolene Driven Compressor

mounted on a strong truck with broad wheels. This outfit is a money-maker where road construction is carried to any extent.

The outfit consists of a high grade gasolene engine with all the necessary accessories and an Ingersoll-Rand dust-proof, self-oiling, high speed compressor with an efficient cooling equipment.

The JACKHAMER

A "One-Man" Rock Drill

is a light but very powerful machine for drilling holes of average depth and size. The rotation and lubrication are entirely automatic in operation.

The valve is of the non-freezing Butterfly Type and the drill **may be operated with either steam or air.**

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$20,000,000

Toronto Harbor Improvements

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Napanee Hoist

Drives the First Pile

and starts the work on this important undertaking.

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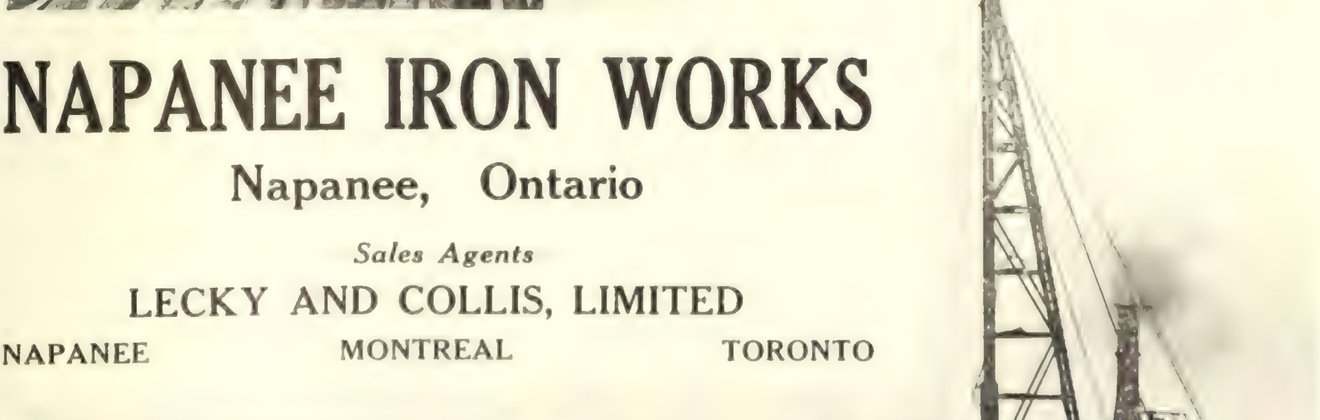
Napanee, Ontario

Sales Agents

LECKY AND COLLIS, LIMITED

NAPANEE MONTREAL TORONTO



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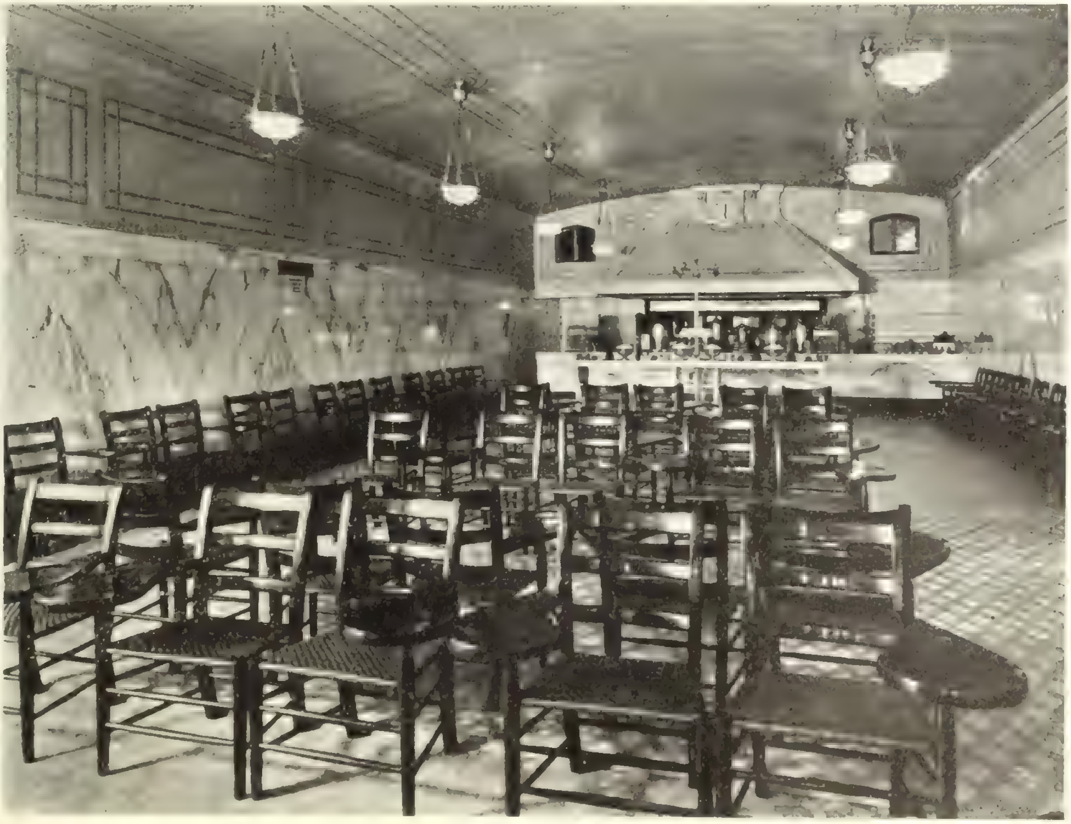

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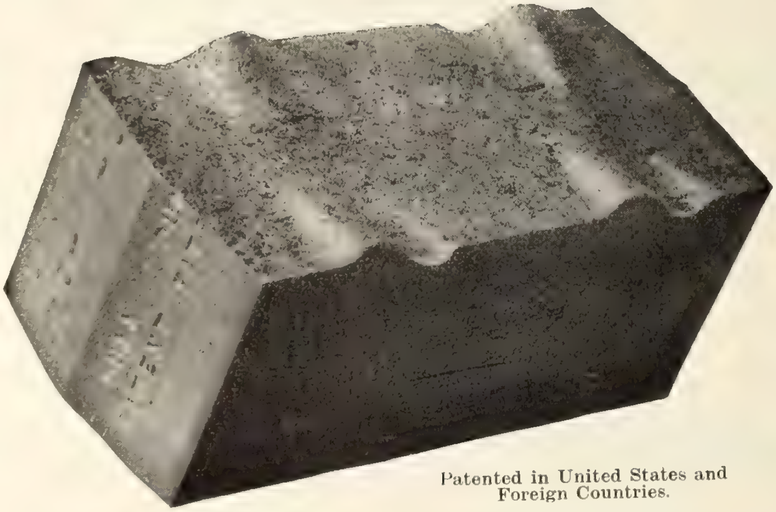

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Conneaut, Ohio

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Dunn Wire-Cut-Lug Brick Company

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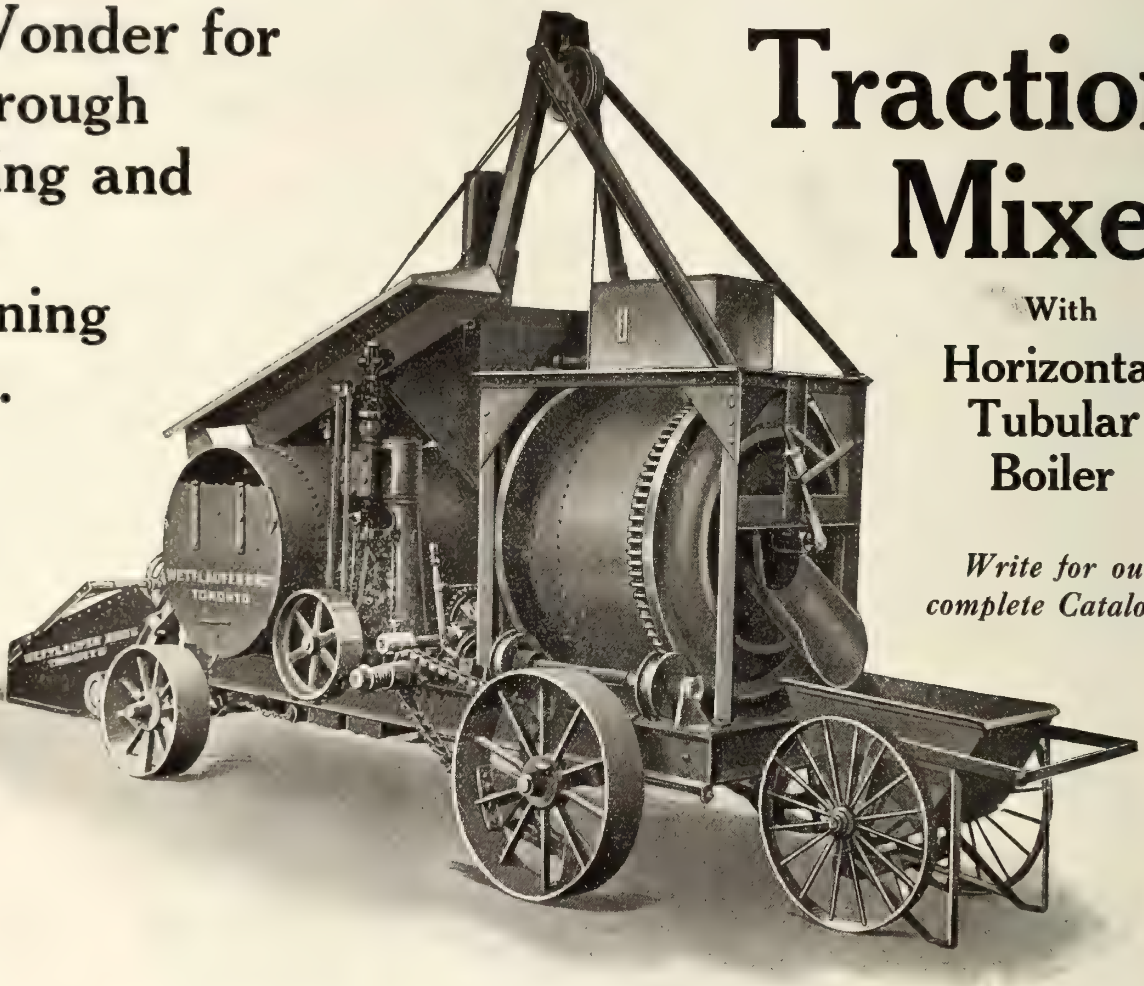

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Improved
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Electric
Hoist
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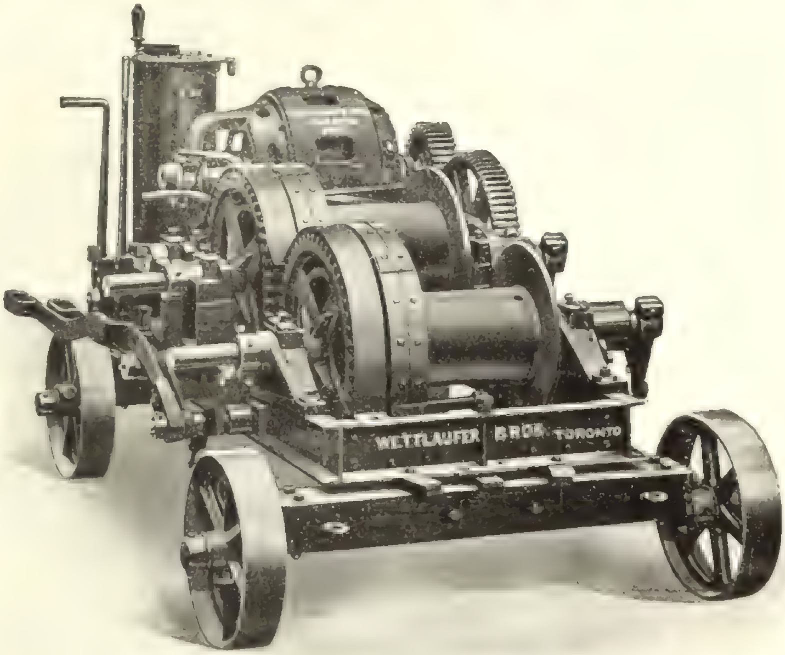

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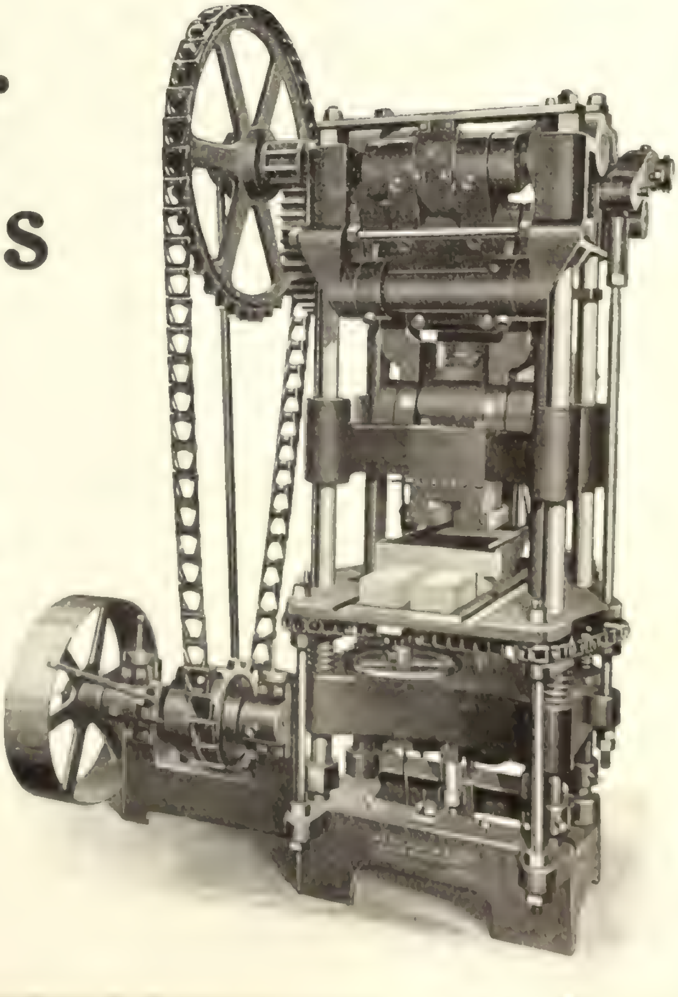

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Florida Keys Sponge & Fruit Co.
By Chas. W. Chase, Jr.

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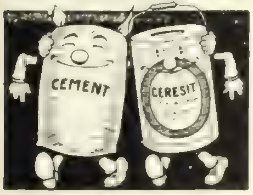

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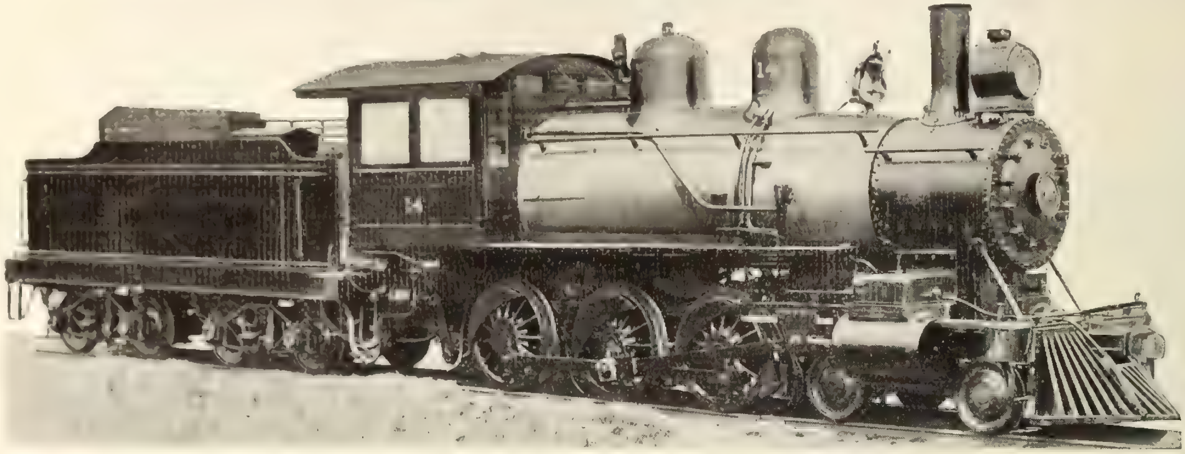

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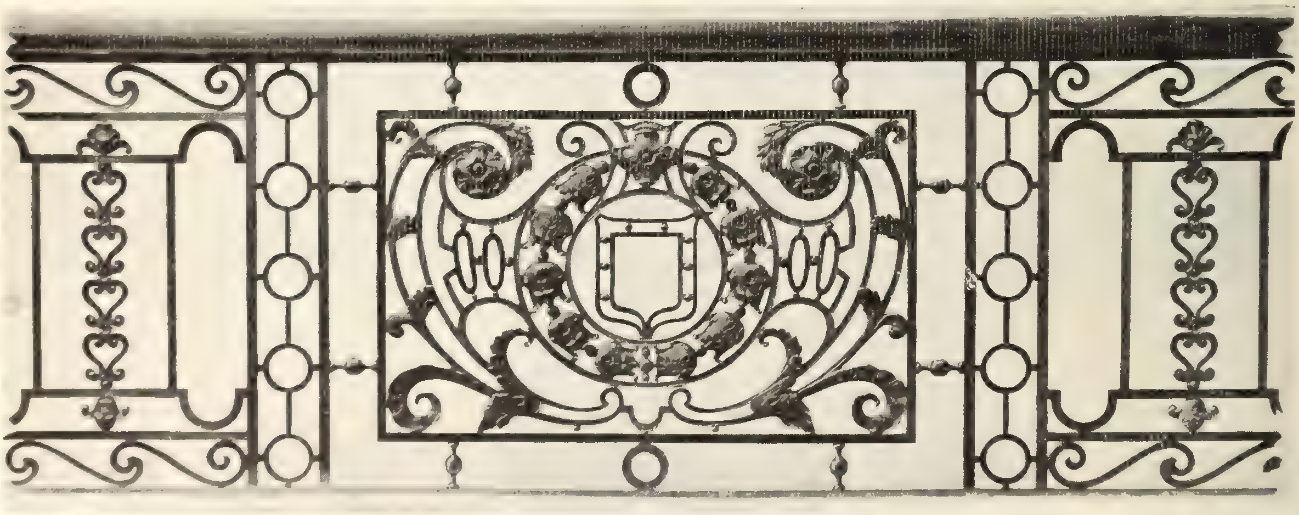

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ESTABLISHED 1886

Contract Record
and Engineering Review

Published Each Wednesday By
HUGH C. MacLEAN, LIMITED
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - Tribune Building
CHICAGO - Tel. Central 6403 - 1155 Peoples Gas Building
LONDON, ENG. - - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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The Constructional Development of Canadian Towns and Cities

ONE of the outstanding features of this number is the First Part of an Alphabetical Reference to practically every town and city of any importance in the Dominion. It is hoped that this reference will be found a useful compendium of constructional data, and readers of this journal are cordially invited to make application tó us for such further information as may be available and which, in cases, may have been withheld owing to considerations of space.

It may be well to emphasize the point that the particulars given are in all cases authoritative, the details having been furnished directly by the municipal officials—generally the City Engineer in collaboration with the City Clerk. Returns have been received from some one hundred and seventy municipalities, of which some seventy are published in Part 1 in this issue. It is hoped to conclude the feature in the issues of May 20 and May 27.

In a general way, the development of the various municipalities during the quinquennial period from 1909 to date is shown, the figures being followed by estimates of constructional work for 1914 and by statements concerning roadway, sewerage, garbage and water supply systems.

We believe that the data given will enable our readers to make many useful deductions and comparisons as their requirements may suggest.

In the compilation of this work we have been greatly indebted to the city engineers and city clerks, to whom, collectively, we tender our best thanks, and we must also acknowledge the supplementary work on this feature contributed by the correspondents of this journal in various centres. The spirit of co-operation shown in this undertaking has been particularly gratifying.

Redundancy is an offence which we do not condone as a rule, but in this instance we make no apology for repeating the invitation contained in the foreword. The Contract Record is essentially a service journal and it is hoped that the reader will not hesitate to avail himself of any additional assistance we may be able to afford him.

The Layman and Sewage Disposal

EFFICIENT sewage disposal, carried out on the most improved methods known, free from odors and nuisance of any kind, and providing no objectionable features in the neighborhood where the works are constructed, is essentially in demand in Canada at the present time.

Last year the city of Toronto put into operation a sewage disposal plant which cost in the neighborhood of half a million dollars. This plant consists of a series of one-compartment sedimentation tanks. Its purpose is to extract the solids from the sewage, the solids being conveyed to Ashbridge's Bay. The liquid sewage is not treated but is allowed to empty into Lake Ontario by means of a long iron syphon pipe.

Since the works have been in operation, deputation after deputation from the neighborhood has made representations to the city council, complaining of the foul odors in the neighborhood.

Before the works were constructed, an American and a British expert were called in by the city to pronounce upon the plans which were designed for the

City Works Department. These experts stated, "No nuisance will arise from the tanks if they are properly constructed and operated, but as an extra safeguard provision will be made to ventilate them by means of an electrically-driven fan fitted with a suitable exhaust pipe." This simply meant that if foul odors did arise, they would be driven forth into the atmosphere by fans. This appears to be what has happened, with the result that habitation within half a mile of the works has become almost unbearable.

It now appears that the whole tank system just completed is wrong in principle and is fit only to be scrapped. In fact, all that Toronto has obtained from its expert advice appears to be represented by a series of old-fashioned septic tanks which have been superseded by improved construction since 1908. In 1908 the septic tank was pronounced a failure by the British Royal Commission on Sewage Disposal. At the time of the proposed installation of the Toronto works, much criticism was offered by other engineers and by the local press, but the certificate of efficiency given by the two outside experts satisfied the city council and killed public criticism for the time being.

Now the question is: what lesson can municipalities learn from Toronto's failure to obtain efficient sewage disposal works?

The municipal council of Toronto have lately shown evidence that before spending any further sum on new works they will learn for themselves just what can be done in the way of obtaining satisfactory results without creating a local nuisance. Just why they did not do so before is a puzzle. Criticism of the proposed scheme was offered freely at the time. Did the council attempt to find out for themselves whether this criticism amounted to anything? Evidently they did not do their whole duty as they now conceive it, or else why this sudden determination to find out for themselves as business men and judge of results from practical showings?

First we find the Toronto council send their Mayor and Commissioner of Works (who is not an engineer) to Georgia to examine a new sewage disposal plant the principle of which is not the septic tank but a tank built on modern principles. Is this the nearest or the only sewage disposal plant on modern principles located on the American continent? Not by any means, according to an article contributed to this issue by Mr. T. Aird Murray. We think that the city of Toronto can learn everything that it is necessary to learn with reference to sewage disposal by staying in Canada and studying the question at home where there are plants in existence built and designed to suit our Canadian winter conditions and which are giving really efficient results.

Secondly we find the city council in a panic—not content to take the report of their Mayor and Commissioner, but resolved to travel in a body to Georgia to find out for themselves if a sewage disposal scheme can be installed without odors or nuisance. And then, thirdly, we find them influenced by the satire of the press—rescinding their resolution and resolving to divide themselves into parties and be personally conducted over various plants on the American continent.

Now we do not grumble at this thirst for exact information which has suddenly seized the members of the Toronto city council, although it might have been in the interests of the city had they discovered the thirst sooner, but there are limitations to the amount of exact information which a body of laymen can obtain on a difficult chemical and engineering matter. Sewage disposal is not represented by any one defined appliance or complete machine, and we must endorse the conclusion at which Mr. Murray arrives in the article to which we have referred, viz., that there is no one system of sewage disposal which can simply be repeated to meet any local condition. In this, all authorities of any note, such as the Local Government Board of England and the Massachusetts Experiment Station at Lawrence, are agreed.

Hence, there is just the trouble that any deputation of laymen—or even of engineers not experienced in this particular class of work—viewing a plant working efficiently under certain defined climatic and other conditions relating to the character of the particular sewage under treatment, may come to the conclusion that this is just the system they want.

It is well and proper that municipal representatives should make themselves thoroughly acquainted with the matters on which they are called to vote public money. No ratepayer can grumble at expense for such purpose. But is it not time that sensible men at the head of affairs in Canada should recognize that this country has a problem of sewage disposal of its own? We have to contend with climatic conditions which are not exactly similar in either Great Britain or the United States. We have certain conditions relating to our water supply from the Great Lakes—a subject which receives careful treatment in Mr. Murray's article. We have engineers in our midst who, for many years, have been studying Canadian conditions relative to sewage disposal. We have several plants in operation in Canada which are giving efficient results and which are, we think, in accordance with modern ideas.

If we were called upon to make any suggestion of a practical character, we would say that the city of Toronto would do well to form a commission consisting partly of its own representatives and partly of scientific men who have studied this question in relation to Canadian conditions, with power to examine into schemes now operating in Canada and to decide as to what particular scheme would fill the bill in Toronto. There is sufficient evidence in Canada itself to allow of an exact determination being made with reference to a final and complete system of sewage disposal for Toronto without the trouble and expense of visits to southern states where the conditions are entirely different from our own.

It is interesting to note that water-front development will form the theme of special discussion at the International Conference on City Planning which is to be held in Toronto, May 25-27. The works now in progress at Toronto should prove of national importance as an example of what may be done by systematic planning for water-front development. The entire harbor project at Toronto will take until 1920 to complete, and will cost upwards of $19,000,000.

Canadian and International Good Roads Congress, Montreal, May 18-23, 1914.

Read the editorial announcement regarding this meeting published elsewhere in this issue.

Canadian Constructional Centres

A Compendium of Engineering and General Progress Data Relating to the Activities of the Principal Towns and Cities of the Dominion. Arranged Alphabetically by Provinces.

PART I.

Newfoundland, Nova Scotia, P.E.I., New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia

WE inaugurate in this issue an **Alphabetical Reference to the Towns and Cities of the Dominion.** This reference consists of a compendium of constructional data calculated to be suggestive and informative to the engineer, the architect and the contractor. In the case of each town and city an attempt has been made to provide sufficient particulars to furnish the reader with some estimate of recent development, to give him some idea of the value, resources and equipment of the municipality, and to enable him to size up the possibilities identified with the programme of expansion for 1914. For obvious reasons this has not been possible of fulfilment in the smaller towns, but the idea has been carried out with considerable success in the case of the larger centres.

As explained in the editorial reference to this feature made on another page, every effort has been put forth to ensure the authenticity of the particulars given. The information has been prepared by municipal officials, and most of the data have been officially revised within the last month, so that the objection to most information of a statistical or semi-statistical nature, viz., that it is "stale" by the time it is printed, cannot be sustained in this case.

Returns have been received from some one hundred and seventy municipalities, a figure which represents nearly ninety per cent. of those to whom application was made—a gratifying result. The particulars asked for included comparative population and assessment figures, comparative returns of building and engineering work, and details as to roadway, sewerage, garbage, water supply and electric light systems. The engineers were requested to furnish information as to the mileage and classification of roadways; as to the sewerage system and the method of disposal; as to the collection and disposal of garbage, as to the source and description of water supply—and so on.

ELECTRIC LIGHT SYSTEMS

The publication of complete statistical information on the various electric light systems scarcely falls within the scope of our present issue, as these details are of interest rather from a technical than an industrial point of view. The real interest centres around the availability of power and its cost. From the technical side it may be said that the distribution systems for light and power practically all over Canada have now been standardized at 2,200 volts, which pressure is reduced to 550 and 110 respectively for power and light. It appears also to be becoming universal practice to establish three phase [illegible] systems, the [illegible] exception to this being that part of south-western Ontario which is served by the Hydro-Electric Power Commission of Ontario from Niagara Falls at 25 cycles.

The cost of electric energy for both power and lighting shows a gradual but persistent tendency towards lower figures, brought about by marked improvements in design of machinery as well as by improvements in operation and management. The proximity of water powers cannot in every case be taken to indicate the possibility of low rates, as there are many cities and towns in Canada operating under advantageous conditions as to coal, gas and crude oil which give rates comparing favorably with the best hydro-electric plants.

In this connection it might be pointed out that a somewhat erroneous idea has existed as to the percentage cost of the power utilized in general manufacturing. This is much smaller than is usually supposed and, except in rare cases under very inefficient management, does not exceed 10 per cent.

In a general way it may be said without fear of contradiction that at practically every point in Canada, the supply of power, either from water, coal, gas or crude oil, is abundantly ample for any possible contingency of the future.

ORDER OF PUBLICATION

In closing these prefatory observations it may be well to say that these articles will be published alphabetically in the order of the provinces, east to west, given above under the main heading on this page. They will be published in **three parts** in the issues of **May 13, May 20 and May 27.**

It was the intention, in the first place, to tabulate the material presented in the following pages, but the varied character and extent of the information given made such an arrangement impracticable. The articles are presented in concise form consistent with intelligent reading. In many cases it has not been found possible to make use of all the information submitted, but such additional particulars as have been withheld by us are at the disposal of the reader, whom we shall be glad to put in touch with Town and City Clerks, City Engineers and municipal representatives.

Newfoundland

St. John's, Newfoundland

This city has a population of about [illegible]. The assessment [illegible] value in 1914 was [illegible]. There are about [illegible] miles of roadways. The sewerage has a main trunk with separate and main intercepting systems, the sewage being discharged into the harbor. Sanitary carts collect the garbage, which is dumped. The water supply is drawn from Winsor Lake, four miles away, and conveyed to the city by gravitation.

Nova Scotia

Amherst, N.S.

The town of Amherst [illegible] the population was 9,130 and to-day it is 11,285. In 1909 the assessment was $3,512,655 and this year it is $4,601,725. The 1914 tax rate is given as probably 22 mills. In 1909 building to the value of $217,000 was carried out in Amherst and the estimate for 1914 is less than half a million dollars. The town has three and one-half miles of bitulithic roadways and contemplates an expenditure of $20,000 on road work during 1914. The sewerage is a combined system, the sewage being discharged into a tidal river. The garbage is collected in cast iron barrels and deposited on a dumping ground near the river. The source of the water supply is the Nappan River and the waterworks comprise a pumping system, storage basin and reservoir. The waterworks extensions contemplated during 1914 will cost $5,000.

Annapolis Royal, N.S.

This centre was incorporated as a town in 1892 and its population at the present time is 1,200. The assessment for 1914 is $321,658 and the tax rate 21.5 mills. There are five miles of earth and gravel roads. There is a sewerage system in a portion of the town, but most of the property is drained off to the river by private sewers and cesspools. A lake, four miles from the town, is the source of water supply.

Canso, N.S.

This town was incorporated fourteen years ago and has a population of 1,630. It possesses fourteen miles of clay and gravel roadways and has no improvements in the way of sewerage or water supply. An electric light plant is being installed at a cost of $15,000.

Digby, N.S.

Digby's population is returned at 1,500 and its assessment at $676,256. Its incorporation as a town took place in 1890. Its tax rate this year is 15 mills. An expenditure of $2,000 is set aside for improvements to its twelve miles of gravelled streets and roads. There is no public sewerage system, private sewers, which drain into the harbor, being in operation. Garbage is collected by carts and deposited in the town dump. The water supply is drawn from the lake and adjacent streams, and conveyed by gravity a distance of three miles to a reservoir near the town.

Dominion, N.S.

This town has a population of 3,000 and was incorporated in 1906. Its assessment for 1914 is $519,000, and its tax rate 25 mills. The town proposes expending $2,000 on improvements to the five miles of streets during the present year. The garbage is collected in carts and dumped. The source of the water supply is Glace Bay, and about $500 has been set aside for waterworks extensions this year.

Halifax, N.S.

The capital city of Nova Scotia was incorporated directly as a city in 1841. In 1909 the population was 44,289 and today it is 55,000. The assessment five years ago was $28,651,050 and the 1914 return is $31,000,000. The tax rate for this year is 20 mills. The building returns for the year 1909 total $538,280, and the estimate for 1914 is in the neighborhood of one million dollars. In 1909 the city engineering expenditure amounted to $313,539 and the estimate for 1914 is $500,000. There are one hundred and one miles of roadways, the types including granite, bitulithic, sheet asphalt, scoria, asphalt macadam, tar macadam, rocmac, porphyry, water-bound macadam and earth. The estimated expenditure for the present year on road work is $75,000. The sewerage is the simple combined system and the method of disposal is by dilution in the harbor. This season an intercepting sewer will be built at a cost of $200,000. Garbage collection is undertaken by the Works Department, teams conveying the refuse to a Stirling incinerator. The water is brought into the city by gravity from the Lakes, there being two systems—high and low service. In the way of waterworks the extensions to be undertaken this season include a distributing reservoir and encircling main estimated to cost $100,000. The electric lighting is operated by private enterprise.

Kentville, N.S.

This town, which was incorporated in 1886, has a population of 2,304. The assessment is rather less than $600,000, there having been no appreciable increase in recent years. The 1914 tax rate is 18.4 mills. The town has thirteen miles of gravel roadways and will expend $5,500 on concrete sidewalks this season. There are three sewerage districts at Kentville—the eastern, the western and the central. The central business district has been laid for seven years and the other districts are to be connected whenever a two-thirds vote of the ratepayers is obtained. The sewage is discharged into the Cornwallis River. The garbage is collected and deposited on a dump. The town's water supply is from Mill Brook, the water flowing from McGill Lake.

Lunenberg, N.S.

The population of this town is 2,700 and the assessment for the present year $1,130,310. There are ten miles of earth roads. A new system of sewerage was constructed in 1913 at a cost of $40,000. The sewage is disposed of in the harbor. The source of the water supply is Canteloupe Lake, the water being pumped to a reservoir of 1,125,000 gals. capacity.

Oxford, N.S.

This is one of the smaller municipalities of Nova Scotia. Its population of 1,200 in 1909 has only been augmented by 92 in the five years to date. The assessment to-day is $275,090 and the tax rate 24 mills. There are six miles of roadways. An expenditure of some $8,000 will be made on local engineering work during 1914.

Pictou, N.S.

Incorporated as a town in 1874, Pictou to-day has a population of 3,300, this being 150 in excess of the population five years ago. The assessment this year is $1,190,020, which is no appreciable increase on that of five years ago. The 1914 tax rate is 25 mills. There are thirty-three miles of roadways, the types being clay and crushed stone, with concrete sidewalks on the main streets. The sum of $4,000 has been set apart for road work this season. There is no proper sewerage system, about two-thirds of the town being sewered privately, the sewers emptying into the waters of Pictou Harbor. The water supply system consists of nine artesian wells, located about half-a-mile from the town limits. The water is pumped into a standpipe, 60 feet by 40 feet, situated on the highest point in the town, and from there is distributed through 12-inch, 8-inch and 6-inch mains. The maximum pressure is 110 pounds and the minimum 45.

Shelburne, N.S.

This town, which received its charter seven years ago, has a population of some 1,500, with an assessment of $371,105. The tax rate this year is 19 mills. There are ten miles of streets and roadways, upon improvements to which an expenditure of $1,000 will be made this year. Nothing in the way of municipal engineering improvements has been carried out, and the only other expenditure this year will be $8,000 on extensions to the electric light system.

Springhill, N.S.

This town was incorporated in the year 1889. It has a population of 6,000—an increase of three hundred during the last five years, in which period the assessment has remained constant at about $800,000. The tax rate for the present year is 25 mills. The road mileage is twenty-four. Only one type of roadway is in use, the material employed being waste from the collieries. The estimated roadway expenditure for 1914 is $3,500. There is no sewerage system excepting street drains. The garbage is collected in carts and deposited on a dump

The water is brought to the town by gravity from a source of supply seven miles distant.

Stellarton, N.S.

This town, which was incorporated in 1889, has a population of about 4,500, an assessment of $1,114,000, and a tax rate of 20 mills. There is no estimate of building work available for the present season, but the engineering department contemplates expending $5,000 on sewerage and waterworks extensions. A like amount will also be expended on road improvements during 1914. There are domestic and also surface drainage systems of sewerage and the sewage is emptied into the river below tide water. The garbage is collected in the usual way and dumped. The water supply is obtained from the river and after filtration is pumped into a reservoir.

Sydney, N.S.

Sydney was incorporated a town in 1886 and as a city in 1904. The population has increased from 15,942 in 1909 to 22,000 in 1914. The total volue of the building work carried out in the former year was rather less than $200,000. The assessment of the city in 1909 was, roughly, $6,000,000, while to-day it is $8,270,400. There are fifty miles of roadways, classified as earth, slag, macadam, and asphalt macadam, with concrete sub-base. The combined system of sewerage in use is gradually being relieved by storm-water sewers. The sewage empties into Sydney Harbor. Within the next few years it is proposed to instal five separate systems of storm-water sewers at an estimated cost of $36,700. The city has no system of garbage collection or disposal. There is a city dump which is controlled by the Board of Health. The source of the water supply is the Sullivan Brook watershed, with an area of 2.3 square miles. The system includes a storage reservoir with a capacity of 200,000,000 Imp. gals. In the field of water-works the extensions planned comprise Middle Lake pumping station and pipe line, estimated to cost $80,000, and 18-inch main for Ward V, estimated to cost $31,000, and smaller main extensions.

Trenton, N.S.

This town was incorporated in 1911, its population at the present time being 2,000. Its assessment this year is $1,125,000 and its tax rate 25 mills. Building work this season will total in value about $65,000. There are five miles of roadways of which there are 2,000 ft. of permanent sidewalks. An expenditure in general improvements will total approximately $18,000, while extensions to the sewerage plant involving an outlay of $18,000 will be carried out this summer. At present the sewage is disposed of in East River. The garbage is collected in carts and dumped outside the town limits. Artesian wells, 300 ft. deep, operated by pumps, supply the water for domestic purposes. A plant is being installed this year at a cost of $50,000.

Truro, N.S.

This town was incorporated in 1875. It has a population of 7,000, an increase of 500 in the last five years. The assessment in 1909 was $2,898,300, as compared with $3,476,200 in 1914. The tax rate this year is 20 mills. The building outlay this season will probably be rather less than $200,000. There are thirty miles of roadways, these being of tarvia macadam, cement and water-bound macadam. The expenditure on roads this season will be $5,000. The sewers are separate system and comprise about 20 miles of mains. The sewage empties into tide-water in the river. Extensions to the sewerage system will be made this season at a cost of $6,000. There is no system of garbage collection and disposal, this being left entirely to the property-owners. The source of the water supply is a brook. A reservoir having a capacity of 30 million gallons is supplemented by a pumping plant at the river. The water works extensions to be carried out this season involve the expenditure of $12,000 and consist largely of replacing the mains with larger pipe.

Westville, N.S.

Westville came into existence as a town in 1894 and has a population of over 4,400 inhabitants. Its assessment is $1,114,000 and its tax rate 18 mills. The building programme this season is estimated to total in value $10,000 and engineering work $7,000. There are twenty-five miles of streets and roadways, classified thus:—stone with field gravel, concrete and ash sidewalks. The sum of $33,600 is the amount set aside for road improvements this year. There is no extensive sewerage system in the town. The water supply is obtained from the Middle River and is pumped into a reservoir after being subjected to filtration.

Prince Edward Island

Charlottetown, P.E.I.

Charlottetown was incorporated as a city in 1855. Its present population of 12,000 represents a decline of 1,000 in half a decade. Its assessment this year is $83,000 and its tax rate 11¼ mills. On street and road improvements an expenditure of $84,000 during 1914 is contemplated. The sewage empties into tidal water. Extensions to the sewerage system are planned and an expenditure of $5,000 will be made in the near future. The garbage is collected by scavengers and dumped. The water supply is obtained from wells and springs, pumped to a reservoir and conveyed to the city by gravity.

Summerside, P.E.I.

This town was incorporated in 1875 and has a population of 3,200—a gain of 400 in five years. In 1913 the assessment was $1,626,940, the gain having been practically negligible in the five-year period. The tax rate for 1914 is 10 mills. The street mileage is about twenty, with fourteen miles of sidewalks. The roadways are earth and macadam, and the sidewalks are of concrete and plank. The sewage is conveyed by two mains to the bay. The water supply is from two artesian wells, 180 feet and 300 feet deep, the water being pumped through the system to a standpipe.

New Brunswick

Campbellton, N.B.

This town was incorporated in 1889. The population has increased from 3,740 to 4,500 during the last five years. Last year's assessment was $36,000 and the tax rate 15 mills. There are seven miles of earth and gravel roadways, and an expenditure of $5,000 on roadways is contemplated this season. The sewerage system is partly combined and partly separate, the sewage being disposed of in tidal water of the Restigouche River. The extensions planned comprise sanitary and storm sewers, with outlet to low water level. The garbage is deposited on a dumping ground outside the town limits. The water supply is brought from lakes by gravity. There are sixty-five fire hydrants and six hundred services. The extensions planned this season include 1,000 feet of cast iron mains and fire hydrants, the whole estimated to cost [illegible]

Chatham, N.B.

The population of this town ([illegible]), which was incorporated in 1896, has remained practically constant during the last five years. The assessment is placed at less than $50,000 and the tax rate is 25 mills. The street mileage is twenty-nine. There are only 2,600 yards of permanent sidewalks. The sum of $45,000 will be spent on street improvements this season. The sewage is discharged into tidal [illegible]

The water supply is from a brook. The laying of a new conduit at a cost of some $17,000 is contemplated.

Dalhousie, N.B.

This town was incorporated in 1905. Its population is 1,800, its assessment $6,725, and its tax rate 12.7 mills. Water is conveyed by gravity a distance of three miles to a reservoir of 1,500,000 gals. capacity. The system is also equipped with a turbine fire pump operated by electric motor. Provision has been made for an expenditure of $2,000 on the lighting system. The water system was completed in 1909 at a cost of $85,000 and the electric lighting plant in 1913 at an outlay of [illegible]

Edmunston, N.B.

This town was incorporated in 1903. It has a population of 1,850, an assessment of $795,900, and a tax rate of 11 mills. Building work this season is estimated to amount in value to approximately $1,000,000. There are about twelve miles of earth and gravel roads. Improvements in this respect entailing an outlay of $2,000 are contemplated in 1914. The town water is supplied by wells and is pumped to a reservoir about 100 ft. above the highest part of the town.

Fredericton, N.B.

Fredericton, the capital of New Brunswick, was created a city in 1848, has a population of 8,500, an assessment for 1914 of $95,000 and a tax rate of 15 mills. The total value of building done in 1913 was $206,400. The city possesses thirty-two miles of streets and roads, their classification being: Hassam pavement, tar macadam, macadam, clay and gravel. Road improvements involving an outlay of $20,000 will be made this season. The sewage empties into the St. John River. A direct pumping plant conveys the water supply from the St. John River into a basin, after which it passes through filters to a clear water reservoir. It is the intention to extend the system this year at a cost of approximately $10,000.

Moncton, N.B.

The city of Moncton has a population of 15,000 and its assessed value is $7,600,000. It received its town charter in 1875 and became a city eight years later. In 1909 the population was 13,000. Last year the tax rate was 16½ mills. The estimated building expenditure this year is $350,000. There are thirty miles of roads, classified as wood block, macadam and earth, and the expenditure in this department this season will be $50,000. The sewerage, which is the combined system, consists of brick trunk sewers and timber outlets, discharging into a tidal river. The extensions planned consist of 1,000 feet of pipe sewer estimated to cost $1,500. The garbage is collected by teams and burned. The water supply is obtained from two brooks. From storage reservoirs the water is brought by gravity to a pumping station. Waterworks extensions are contemplated at a cost of $8,000

Newcastle, N.B.

This town was incorporated in 1899 and has a population of 2,500, which has decreased from 3,000 since 1909. The assessment in the latter year was $30,000 and to-day it is $36,000. It is planned to expend $10,000 on road improvements this season. The sewage empties into the river. The water supply is obtained from artesian wells, the water being pumped to a reservoir and distributed by gravity.

Sackville, N.B.

Incorporated a town in 1903, Sackville has a population to-day of about 2,300. Its assessment for 1914 is $1,160,000 and its tax rate 15.2 mills. The streets and roadways are of earth and stone, and concrete sidewalks are at present being laid. The question of constructing permanent streets throughout the town is now under consideration. The sewerage system consists of large wooden mains and vitrified clay pipes, varying in diameter from 14 ins. to 8 ins., the houses generally connecting with a 6-in. pipe. The sewage empties into the river. Frequent extensions to the sewerage system have been carried out and further improvements are contemplated. The source of the water supply is springs, located about three miles from the town. The water is conveyed by gravity.

Shediac, N.B.

This town was incorporated in 1903. Its population of 1,600 in 1909 has advanced to 2,000 to-day. The tax rate for 1914 is 17.5 mills. Five years ago the value of building work carried out was only $5,000. The estimate under that head for the present year is $75,000. The extent of roadways is under four miles. The water supply is drawn from an artesian well. The overflow is taken care of in a reservoir, pumped into an elevated tank and distributed by pressure.

St. Andrews, N.B.

At St. Andrews, which became a town in 1903, the population has increased from 1,000 to 1,200 in the last five years and the assessment in the same period from rather more than $6,000 to $11,000. There are twenty miles of roadways, the classification being given as earth, broken stone and gravel. The sum of $1,500 will be expended on road work this season. The sewage discharges into the harbor. The sewerage system will be enlarged as required, a plan embracing the necessary extensions having been made. The garbage is collected by teams and dumped near the shore. The use of scows in the disposal of the garbage is contemplated in the near future. The water supply is from Chamcook Lake, the water being conveyed through an iron pipe to a reservoir. The town is considering the installation of an electric light system this season.

St. John, N.B.

The city charter of St. John dates back to 1785. The present population is perhaps 45,000, the 1911 census giving it as 42,511. No estimates of expenditure on building and engineering work are obtainable at the time of writing. The city s roadway mileage is 52.3, the various types of construction comprising stone block, wood block, asphalt, tar macadam, broken stone and gravel. The city's sewage is discharged directly into the sea. The garbage is removed at the expense of the property-owners. The water supply is brought into the city by gravitation from lakes. During 1913 about two miles of water mains were renewed at a total cost of $21,862 and 7,000 feet of new pipe was laid at a cost of $20,828. Sewer extensions measured 8,384 feet and the cost was $20,060.

St. Stephen, N.B.

This town was incorporated in 1871 and its population of rather less than 3,000 has remained practically stationary during the last five years. The assessment is $40,000 in round figures and the tax rate for 1914 is 20 mills. There are fifteen miles of roadways, principally macadam, and $5,000 will be expended on road work this season. The sewerage system consists principally of brick mains. The sewage empties into tide water. The water is supplied from a spring three miles distant, it being pumped to a reservoir and distributed by gravity from a 300-ft. head.

Quebec

Beaconsfield, Que.

This town, which was incorporated in 1910, has a population of 1,200 and is assessed at rather more than $1,000,000. The estimate for building and engineering work combined this season is $56,000. There are five and one-half miles of tar macadam and water-bound macadam roads. Extensions to the electric light system are planned at a cost of $20,000.

Chicoutimi, Que.

This town, which was incorporated in 1879, has shown rather rapid development in recent years, the population having increased from 4,000 in 1909 to 6,500 to-day, and the assessment in the same period from $1,300,000 to $2,200,000. It is estimated that building work to the value of more than $1,000,000 and engineering work to the extent of $80,000 will be carried out during 1914. The 1914 tax rate is 12.5 mills. Details of engineering work for the season are as follows:—macadam roads, $30,000; tarvia-filled macadam, $20,000; concrete sidewalks and retaining walls, $20,000, and sewers, $10,000—total $80,000. The present mileage of roadways is fifteen, upon improvements to which an expenditure of $50,000 will be made this season. There is a combined system of sewerage, the method of disposal being by dilution. Extensions to the sewerage system are planned at a cost of $5,000. The garbage is collected in wagons, the method of disposal in use being given as "dilution and fire." The town's water supply is from the Chicoutimi River. At present certain extensions are under way, primarily a 12-inch cast iron pipe being actually under contract for $50,000.

Fraserville, Que.

Fraserville was incorporated a town in 1874 and a city in 1910. Its population has increased from 4,300 in 1909 to 7,000 to-day. The 1914 tax rate is 7.5 mills. The building programme for 1914 is estimated to total in value well over $2,000,000. There are about twelve miles of streets, seven miles of which are gravel and five macadam. About $10,000 will be expended this season on road improvements. There is a complete system of waterworks and sewerage in all sections of the city. The water supply is obtained from the Green River.

Granby, Que.

In 1909 the population of this village was 4,000 and to-day it is 6,000. The tax rate for the year is 15 mills. The roadway mileage is eight, this including four miles of macadam. The sewage is discharged into the Yamaska River. There is no system of garbage collection or disposal. Water is conveyed to the village by gravity under a 300-ft. head from Shefford Mountain. Waterworks extensions in the shape of a 12-in. main estimated to cost $20,000 are contemplated.

Joliette, Que.

Incorporated in 1863, this town has grown in population from 5,793 in 1908 to 7,636 in 1913, the assessment during that period having increased from $1,413,200 to $2,589,220. The tax rate last year was nine mills. The building programme this year is estimated to total in value about $50,000. The roadway mileage is small, but about $15,000 will be expended on bituminous asphalt work this season. The sewage is discharged into the river. The garbage is collected and dumped outside the town. The source of the water supply is L'Assomption River. Reports contemplating the carrying out of considerable extensions to the pumping system have been submitted.

Lennoxville, Que.

In 1909 this village had a population of 1,224, which has now increased to 1,314. The assessment to-day is $453,000, as against rather more than $300,000 five years ago. The tax rate last year was 13½ mills. Building is proceeding on a small scale, the estimate for 1914 being $10,000. There are fifteen miles of earth and gravel roadways, and the 1914 expenditure on road work is estimated at $2,000. The sewage is discharged into the river. Sewerage extensions are planned this season to cost $1,000. There is no municipal garbage system, the refuse being disposed of privately. The water supply is obtained from springs and is also pumped from the river.

Levis, Que.

Incorporated in 1861, this town has a population of 8,000, an increase of 1,000 persons in half a decade. The present assessment, in round figures, is $3,000,000, an increase of nearly three-quarters of a million on the 1909 assessment. The tax rate for 1914 is 7.8 mills. The roadway mileage is twelve, no classification having been furnished. There is a sewerage system in operation. The water supply is from the St. Lawrence River, with steam and electric pumping systems. The electric lighting is owned by the Quebec Railway, Light, Heat & Power Company.

Montreal, Que.

Montreal, the commercial metropolis and national port of Canada, began its real municipal existence in 1833, when the first mayor and council were elected. The population returns for the last half century are illuminating as to the growth of the city. In 1861 the population was 91,000. This had increased to 107,000 by 1871, to 211,000 by 1881, and to 266,000 by 1901. To-day the official figures are, Montreal proper, 568,000, and Greater Montreal, 652,000. The assessed valuation of property in 1909 was $327,000,000 and to-day it is $791,000,000. The building returns for the last five years are as follows: 1909, $7,785,621; 1910, $15,715,859; 1911, $14,759,632; 1912, $19,408,690; 1913, $27,037,097. The 1914 estimated building expenditure for Greater Montreal is $30,000,000. In 1909 municipal engineering work to the value of $1,500,000 was carried out and the 1914 estimate is $7,000,000. Montreal has 480 miles of roadways, the classification being given as asphalt, scoria and granite blocks, 109 miles, and the balance macadam. The estimate for road work this year is $3,800,000. The city's sewers are constructed on the combined system, the main sewers draining mostly into the River St. Lawrence without purification. The sewage discharged into the Back River is purified. Until recently all the sewers were of brick construction, but concrete is now being used for the large sewers. One 8-ft. sewer in Longue Pointe has been constructed of reinforced concrete and brick work. Intermittent filtration is employed, storm overflows discharging directly into the stream. There are two sewage farms, one in Notre Dame de Grace and the other in Upper St. Denis Ward. The Notre Dame de Grace farm, however, is practically useless and the city is building a trunk sewer from Notre Dame de Grace to Cartierville, a distance of five miles. This is being built in three sections, at an approximate cost of $750,000. Montreal's heavy sewerage work has been necessitated by the recent annexation of outlying districts. The extensions planned this season comprise main sewers, with sewage disposal works, the whole estimated to cost $1,500,000. Apart from the waterworks the city does not possess any public utilities, the lighting system, tram cars, power plants, etc., being in private hands. The Contract Record has given so many details about the Montreal waterworks that it is sufficient to say that the source of supply is the St. Lawrence River, at the read of the Lachine Rapids. The water is conveyed to the pumping station through a concrete conduit five miles long. The aqueduct is now being enlarged and a new filtration plant is in course of construction. The city collects the garbage twice a week in carts and has three dumps and one incinerator. The electric light system is owned and operated by the Montreal Light, Heat and Power Company, which has a lighting contract with the city. One of the most important works now being carried out is the construction of an un [illegible] and conduit system, in which all wires for power, light etc., will be carried.

Outremont, Que.

Outremont, a suburb of Montreal, was incorporated as a town in 1895 and its population has grown from 2,000 persons in 1909 to 10,000 in 1914. The tax rate for the present year is seven mills. The assessment five years ago was slightly in excess of $3,000,000 and to-day it is over twenty million dollars. The value of the building work carried out in 1909 was $609,000 and the estimated expenditure for the present year is $2,000,000. The expenditure on municipal engineering works for the last four years is as follows: 1910, $139,118; 1911, $491,282; 1912, $348,361; 1913, $245,267. There are 22.4 miles of streets, thirteen of which are macadamized. The town has 23½ miles of 5-ft. and 6-ft. concrete sidewalks. The estimated expenditure on road work for 1914 is $100,000. The combined system of sewerage is in operation, there being 15.6 miles of brick sewers, and 1.1 mile of tile pipe sewers. The sewage is discharged into the sewers of the city of Montreal. The sewerage extensions planned this year are estimated to cost $50,000. The garbage is collected by the municipality, which is contemplating the erection of a small destructor plant. Filtered water from the St. Lawrence River is furnished by the Montreal Water & Power Company. The electric light system will be extended this year at a cost of $75,000.

Pointe Claire, Que.

Incorporated a town in 1911, Pointe Claire has a population of 2,833. Its assessment this year is $1,800,000 and tax rate 7.5 mills. There are six miles of macadam roads. The projected expenditure during 1914 on road improvements will be approximately $90,000, the laying of 4½ miles of roadways being contemplated, but the nature of the surface has not yet been decided on. The system of sewerage is "separate gravity" to central points, where the sewage is pumped into Imhoff sedimentation tanks and treated before discharging into the Lake. The source of the town's water supply is Lake St. Louis, the plant consisting of one 60 h.p. electric turbine pump and one reciprocating steam pump as a reserve duplicate. The normal pressure with standpipe is 60 lbs. and direct from pump 110 lbs. The steel mains vary in diameter from 12-in. to 6-in .

Quebec, Que.

The historic city of Quebec received its charter in 1833. The growth of population in the quinquennial period from 1909 to 1914 has been seven thousand, the figures being 78,000 and 85,000 respectively. The roadway mileage is 80, the types of construction being macadam, asphalt, asphalt block, scoria, brick and granite. This season's road work will consist chiefly of 20,000 yards of bituminous macadam. The sewerage is of the ordinary type and the sewage empties into the St. Charles river. Extensions to the sewerage system are to be made this season, but the details are not settled. Collection and disposal of garbage at Quebec is an open question at present, a new method now being considered by the Health Department. The water supply is from the St. Charles Lake, eight miles from the city. The newly-annexed Belvedere ward has a private aqueduct. Waterworks extensions in Belvedere ward and Limoilou are contemplated. The electric light plant is the property of the Dorchester Electric Company. The installation of another unit of 1,000 h.p. is to be made.

Sherbrooke, Que.

Incorporated a town in 1840 and a city in 1875, Sherbrooke is making constant progress, the population having increased from 15,300 in 1909 to 20,000 in 1914 and the assessment in the same period from $6,300,000 to $9,800,000. The 1914 tax rate is 19½ mills, including schools. Five years ago the building operations carried out during the year (1909) represented an expenditure of rather more than $6,000,000 and municipal engineering work totalled $100,000. The building expenditure for 1913-1914 is estimated at $12,000,000, while engineering work to the value of $200,000 will be carried out. The city has about forty miles of macadam roadways and will spend about $200,000 on road work this year. The sewerage is on the combined system, tile pipe and brick mains being used. The sewage is discharged into the river. The city is now having plans prepared for a new sewerage system, with certain extensions, the whole estimated to cost $200,000. The garbage is collected by the city under the direction of a sanitary officer, the refuse being burned. Water is obtained from the Magog River, at a point four miles up from the centre of the city. The water is pumped by hydraulic power from the source to a reservoir having a capacity of 10,000,000 Imperial gallons. This reservoir is situated 190 feet above the pumps and 320 feet above the lowest part of the city. Extensions to the waterworks are contemplated this season at a cost of $30,000. Extensions to the electric light and gas plants at a cost of $100,000 are under consideration. These will consist of a new concrete dam to be erected at the city's central station to replace the old wooden dam and also the erection of a new gas holder, big enough to store a week's supply of gas. The city has two hydraulic generating plants capable of running separate or parallel, their capacity being 5,500 h.p. There are also two undeveloped water powers, one on the Magog River and the other on the St. Francis River, where 6,000 h.p. could be developed. There are 4,300 electric light and power customers and 700 gas customers. Power is sold at ¾ cents per kw. hour and light at .06 cents per kw. hour, less 10 per cent. discount There is a flat rate for sign and window lighting of $1.50 per 50 watts per annum, and for heating or cooking, .02 cents per kw. hour. Gas is sold at $1.25 per 1,000 cu. ft. net.

St. Hyacinthe, Que.

Incorporated a town in 1850 and a city seven years later, St. Hyacinthe has a population to-day of 11,620. Its assessment is $3,381,875 and its tax rate 7½ mills. The sewage is discharged into the Yamaska River. The streets are of macadam. The source of the water supply is the Yamaska River.

St. Lambert, Que.

St. Lambert was incorporated in 1898. Since then its population has increased from 2,600 to 5,000, its assessment from $1,000,000 to $4,500,000, and its building expenditure from $30,000 to an estimated outlay of $500,000 in the current year. The 1913 tax rate was 8½ mills. The roadway mileage is roughly twenty-seven, the classification being given as: earth roads 22, asphalt 1.43, and macadam 3.82. It is proposed to expend $400,000 during the current year on engineering work. Of this sum $300,000 will be expended on converting the present separate and combined sewage system into a separate system. $150,000 is the estimated cost of sanitary and storm sewers, and $150,000 of a disposal plant on the sedimentation and disinfection plan. It is also intended to expend $100,000 on bitulithic and bituminous macadam pavements and concrete sidewalks. The garbage is collected in open wagons and destroyed by incineration. Water is obtained from the St. Lawrence River and pumped into a water tower by an electrically-driven Worthington turbine, with 540,000 gals. capacity. A set of reserve pumps, driven by steam, have a capacity of 1,050,000 gals. a day, making the total capacity 1,590,000 Imp. gals. The length of the mains is 44,359 feet, the pipes being 4 to 10 in. capacity. It is probable that 17,217 feet of mains and 41 hydrants will be put in this season at a cost of $20,000. Extensions to the electric lighting system are also planned, the cost being $10,000.

Thetford Mines, Que.

Thetford Mines has a population of 7,200, its incorporation as a town having taken place in 1905 and as a city seven years later. Its assessment for 1914 is $2,300,000. The tax rate for 1914 is 7.5 mills. Building this season is expected to be small, only about $3,000 being the estimated value of permits for 1914. On engineering work, however, an outlay of $50,000 is contemplated. There are nine miles of streets, three of which are macadam, the balance being earth. The expenditure under this head during 1914 will be approximately $60,000. The sewage is disposed of in the Thetford River, and a sum of $10,000 will be expended on extensions. There is a gravity system of water supply, derived from springs. The waterworks plant will be extended in the near future at an estimated cost of $10,000.

Valleyfield, Que.

Incorporated in 1875 a town and in 1904 a city, Valleyfield to-day has a population of some 10,000. The streets are macadamized and the sewage of the city is conveyed through vitrified clay pipes and discharged into a tail-race. The source of the city's water supply is the St. Lawrence River.

Verdun, Que.

Incorporated a town in 1907 and a city in 1912, Verdun to-day has a population of 27,000 as compared with 10,000 five years ago. The assessment for 1914 is $350,000, as compared with $100,000 in 1909. In the latter year the building expenditure was rather less than $60,000, while the estimate for 1914 is five and one-half millions. The expenditure on engineering work in 1909 was $200,000 and the estimate for the present season is $500,000. There are twelve miles of macadam roadways in Verdun and the estimated expenditure on road work for 1914 is $100,000. The sewerage is on the combined system, the sewage being discharged into the river after treatment. Extensions to the sewerage system will be made this season at a cost of $75,000. The garbage is collected in carts and deposited on a covered dump. The water supply is from the St. Lawrence River. Extensions to both the waterworks and electric light systems are contemplated. Both systems are municipally owned.

Westmount, Que.

Westmount was incorporated a town in 1895 and received its charter as a city in 1908. The population to-day is 18,500, as compared with 13,000 in 1909, and the assessment is $50,000,000, as compared with $27,000,000. The building expenditure in 1909 was $1,417,600, the estimate for 1914 being $2,000,000. The corresponding figures for municipal engineering work are $178,000 and $131,826. The tax rate for the present year is nine mills. There are twenty-seven miles of roadways, the various types being asphalt, tar macadam, rocmac, bitulithic and macadam. The estimated expenditure on road work this season is over $126,000, which includes the draining and concrete paving of lanes. The sewerage is on the combined system, the sewage being discharged into the sewers of the city of Montreal. The sewerage extensions contemplated this season involve an expenditure of $41,768. The garbage is collected twice a week by horse and motor vehicles, the method of disposal being by means of a Meldrum destructor and a Heenan & Froude destructor, each plant having a capacity of fifty tons. The water, which is drawn from the St. Lawrence River and filtered by a rapid mechanical sand plant, is furnished the city by the Montreal Water & Power Company. The electric light system is owned by the municipality, which lights its own streets and also supplies light for domestic purposes. The Montreal Light, Heat and Power Company is a competitor for the domestic supply. It is proposed to carry out an extensive improvement of street lighting at a cost of $250,000, together with the construction of underground conduits. Part of this work, including a portion of the installation of magnetite arc lamps, has already been done.

Ontario (Cities)

Belleville, Ont.

The municipal history of Belleville, Ont., dates back to 1850, when it received its charter as a town. It was incorporated as a city in 1878. Coming down to modern times the growth has been satisfactory in recent years, the population having increased from 9,515 in 1909 to nearly 12,000 to-day, and the assessment in the same period from rather more than four millions to six millions. The value of building work carried out in 1909 was $100,000. The estimated expenditure on building work this season is $400,000 and on engineering work, $63,000. In the way of road work, $45,000 is the estimated expenditure on asphalt concrete pavements to be laid during 1914. The sewage discharges into the Moira River. Considerable extensions to the sewerage system are planned. The garbage is collected in carts and deposited on a dumping ground. Water is obtained from the Bay of Quinte, steam and electric pumps being in operation.

Berlin, Ont.

This town was incorporated in 1854 and received its city charter two years ago. Its population to-day is nearly 19,000, an increase of some 6,000 during the last five years. Last year the assessment was 9½ million dollars, three millions in excess of the figures for 1909. This year's tax rate was 23¾ mills. In 1913 the building work carried out represented an expenditure of $650,000, compared with $350,000 in 1910. The roadway mileage is 29.4, the classification being as follows:—macadam, 24;tarvia, 3, and bitulithic, 2.4. The present season's road work is estimated to cost $100,000. The city has 32 miles of lateral sewers. The trunk sewer built in 1913 consists of 9,500 lineal feet of 48-in. reinforced concrete pipe; 3,300 lineal feet of 30-in. sewer pipe and 5,400 lineal feet of 18-in. sewer pipe. The disposal system consists of three septic tanks, with a capacity of 525,000 gallons, two storage tanks, with a capacity of 450,000 gallons, and sand filtration beds fourteen acres in extent. Extensions to the sewerage system for 1914 comprise new filter beds at a cost of $10,000 and lateral sewers at the same amount. Garbage is collected by contract and dumped on to low ground. The water supply is from artesian wells, the following works having been constructed in 1912 and 1913: concrete water tower, with a capacity of 600,000 gallons, a reservoir, with a capacity of 1,000,000 gallons, and electric pumping equipment. Electric light extensions costing $15,000 are projected.

Brantford, Ont.

The Telephone City, as Brantford has been called, was incorporated as a town in 1847 and received its city charter in 1878. Its population of [illegible] in 1909 has increased to 26,454 in 1914, and the assessment in the same period has grown from 11½ millions to over 20 millions. In 1909 the value of building was $[illegible] and the 1914 estimate is $[illegible], the corresponding figures for municipal engineering work being $[illegible] and $[illegible]. The 1914 tax rate is 22½ mills. The roadway mileage is seventy, classified as follows:—bitulithic, [illegible]; westrumite, [illegible]; asphaltic concrete, [illegible]; concrete, .20; asphalt block, .05, and macadam and gravel, 64.75. This season the city of Brantford will expend the sum of $60,000 on road work. The [illegible] is the separate system, the sewage from the low lying areas being pumped to main sewer for sanitary sewers. The storm sewers are for storm water only. Both systems discharge into the Grand River. The extensions planned this season comprise street mains for the sanitary sewers at a cost of $50,000 and for the storm sewers at a cost of $20,000. The garbage is collected weekly by the city, which is divided for this purpose into six districts. The garbage is taken from the yards to vacant property owned by the city. The water supply is from the Grand River. The water is filtered by the natural sand process. A direct pressure system is in operation. This season extensions to the waterworks will be made at a cost of $150,000. The electric light system is to be enlarged at a cost of $75,000.

Chatham, Ont.

Chatham came into existence as a county town in 1850, its incorporation as a city dating from 1895. Its population is 13,000 and its assessment last year was $7,264,584, an increase of over $2,000,000 in the last five years. In 1913 its tax rate was 24 mills. The building programme for the present season is estimated to cost $400,000 and the outlay contemplated by the Engineering Department is $50,000. The city possesses eighteen miles of earth roads and fourteen miles of paved streets, the latter being classified as follows: bitulithic, vitrified brick, asphalt block and concrete. An expenditure of $20,000 on road work is contemplated during the present year. A combined system of sanitary and storm sewers is in operation, the method of disposal being dilution in the river. Extensions to the system, involving an outlay of $10,000, are planned. The garbage is collected weekly by wagon and dumped outside the city limits. The source of the water supply is the River Thames, the raw water being pumped into a sedimentation basin with a capacity for a five days' supply. From there it is pumped into mechanical filters through the mains. Extensions to the system have been plannel at an estimated outlay of $5,000. Hydro-electric lighting has been contracted for and it is the intention to remodel the entire lighting system.

Fort William, Ont.

Fort William was incorporated as a town in 1892 and as a city in 1907. Its population has advanced from 18,000 in 1909 to 25,000 to-day. In 1909 the assessment stood at $14,497,240, the amount under this head for the present year being $44,121,979. The estimated tax rate for 1914 is 23 mills. The value of building carried out five years ago totalled $2,970,365, whereas the expenditure in the same connection for the present year is estimated to reach $5,000,000. In 1909 the city expended $465,333 on engineering work, including electric lighting, and the total amount exclusive of the electric lighting improvements estimated for the present year is $1,135,300. There are 128 miles of roadways, 114 of which are graded and the balance distributed amongst asphalt blocks, sheet asphalt, bitulithic, rocmac, macadam and gravel. The expenditure under this head for the present year is $123,900 for paving, $185,800 for road macadam and $145,600 for gravel, a total of $455,300. The sewerage system is the combined type, consisting of tile, 12 in. to 18 in. in diameter, and reinforced concrete sewers, 2 ft. to 7 ft. in diameter. There are 25 outlets, 13 of which discharge untreated into the Beebing River and 12 into the Kaministiquia River. An extension to the system is planned at an estimated cost of $40,000 for 5 ft. diameter reinforced concrete sewers and an equal amount for tile. The garbage is collected by teams and conveyed in gondola cars to a high temperature, 3-cell incinerator. The water supply is drawn from Loch Lomond by gravity, six miles from the city, the system comprising a tunnel, 5 ft. by 4 ft. from the Lake to forebay, and one 24-in. and one 18-in. cast iron main from forebay to reservoir, with two 18-in. mains from reservoir to city. The Kaministiquia and Mission Rivers are crossed by duplicate pipe lines laid under the river beds. Extensions to the distribution mains at a cost of $300,000 are contemplated. The electric lighting system will be extended at an outlay of $75,000 for lines and sub-station.

Guelph, Ont.

The Royal City came into existence as a city in 1879 and its population, which in 1909 stood at 14,060, is now 16,319. Its assessment has increased in the same ratio, it being at present $10,722,533. The tax rate in 1913 was 24 mills. The estimated value of building contemplated this year is $450,000, which compares with an expenditure of $127,625 five years ago. The city has nearly four miles of pavements, consisting of asphalt, macadam, asphalt block and paving brick. Two septic tanks and thirteen filter beds comprise the sewage disposal plant, the effluent being discharged into the river. Teams are employed for the removal of garbage, which is dumped. The water supply is drawn from springs and conveyed by gravity to the city reservoir and thence by steam pump to mains and standpipe. Some $10,000 will be expended on extensions to the electric lighting system. Guelph claims that there is only one other city in the Dominion which supplies power to its citizens at a lower rate, the rate at Guelph being 80c per 1,000 cu. ft. for manufacturing purposes. There are 21 miles of main and 3,000 services. To-day Guelph has eighty manufacturing industries, which have a total capital of $8,500,000. Ten years ago the total capital of the manufacturing concerns was $3,562,641.

Hamilton, Ont.

This city, one of the most important manufacturing centres of Canada, has a population of nearly 101,000. It was incorporated in 1847 when its inhabitants numbered less than 7,000. Its growth has been most marked in recent years, its population having nearly doubled since 1901. Five years ago the population returns were rather less than 67,000. The assessment value to-day is $80,000,000, as compared with $34,000,000 in 1909. The 1914 tax rate is 20 mills. The estimate of building construction this year is $5,000,000. The mileage of permanent roadways is 31, made up as follows: asphalt and wood block, 8.65; brick, .2; wood block, 1.8; asphalt and brick, 4.35; asphalt, 12.3; asphalt macadam, 3.7. About eight miles of pavement, mostly asphalt, will be built this year. The standard pavement for streets having car tracks is with wooden blocks between the rails. The city has two asphalt plants—each of 15,000 yards daily capacity. The paving work is done by day labor. The city's sewage is taken care of by two chemical precipitation plants, the effluent being turned direct into Burlington Bay. One plant, with septic tanks and sprinkler filters, is being remodelled after the Emscher tanks, the effluent to be discharged into the Desjardins canal. The extensions planned involve an expenditure of $250,000. The water supply is from Lake Ontario by direct pumping from the lake to compensating reservoir. There are three intakes into Lake Ontario to the settling basins, from which there are three conduits to pumping station. In the pumping station there are four electrically-driven turbine pumps, each of 7,000,000 gallons capacity every 24 hours, and four pumps driven by steam engines, with a total capacity of 14,000,000 gallons every 24 hours. From the pumping station to the city there are four mains, 18-in., 20-in., 30-in. and 36-in. The high level pumping station, taking water from the city mains, has two electrical pumps, each of one million gallons capacity, pumping to the higher level of the city, which is below the mountain ridge, and two one-million gallon pumps pumping to a tank on the mountain top to supply the residents of that district inside the city limits. The city's garbage is collected by wagons and deposited on city dumps covered with earth to fill low land. In July, 1911, a by-law was passed to raise $505,000 for hydro-electric power and the extensions planned in this department comprise the completion of the work at a cost of $200,000.

Kingston, Ont.

Incorporated as a town in 1838 and as a city eight years later, Kingston has advanced in population during the last five years from 19,000 to over 21,000. Its assessment in 1909 stood at $8,653,625 and is at present $11,949,577. Probably $675,000 will be spent on building this season and about $125,000 on engineering work. The city roadway mileage includes 1.173 miles of asphalt block on 4-in. concrete base and .894 miles of asphaltic macadam on macadam foundation. Seventy-five thousand dollars is the amount set aside for this year's road improvements. A combined system of sewerage is in operation, with outlets into the harbour at different points. Garbage is collected in wagons by contract and dumped beyond the city limits. Lake Ontario is the source of the water supply, the plant consisting of a steam pump of 7,000,000 gals. capacity and a tank holding 628,000 Imperial gallons. The mains are 2-in. to 18-in. in diameter. Extensions to the system involving an expenditure of $30,000 are contemplated. The electric lighting system will be extended by completing the underground conduit system and installing 175 magnetite arcs.

London, Ont.

London was incorporated as a town in 1848 and became a city in 1854. Its population was 49,430 in 1909 and at the present time it is slightly over 55,000. The city's assessment five years ago was $25,664,484, and to-day is, roughly, $33,000,000. Last year the tax rate stood at 24.9 mills. The value of building work carried out in 1909 was $850,134; in 1913 the amount totalled $1,789,920, and the present year's estimate under this head is $2,000,000. In the engineering department rather more than $200,000 was expended five years ago, and the estimate this year amounts to $425,000, made up of the following items:—local improvements, $175,000; construction of part storm sewers, $150,000; sewage disposal and trunk sewer, $75,000; river retaining wall, $25,000. The city's roadways total 136 miles, classified thus:—asphalt, bitulithic, brick, asphalt block, reinforced concrete, macadam and gravel, including 11 miles of permanent pavement. In road construction, extensions contemplated this year amount to $125,000 for the laying of permanent pavements. A combined sewerage system is in operation, this consisting of 14,800 ft. of sewers 24 in. in diameter and larger, 59,200 ft. of less than 24 in. diameter, 9,600 ft. storm sewers of lesser diameter than 24 in., 206,800 ft. of sanitary sewers of lesser diameter than 18 in. and 71,300 ft. of trunk sewers, and three interceptors. The method of disposal consists of sedimentation tanks and bacteria beds, the effluent discharging into the river one mile west of the city. Contemplated extensions to the [illegible] and trunk sewer in the eastern district at an outlay of $75,000. The garbage is collected in wagons and carts, supplied by the city, and disposed of in a 3-cell 50-ton Heenan & Froude incinerator. Surplus steam from the incinerator is utilized in heating a public institution in the vicinity. The source of the water supply [illegible]ural flow water is raised from collecting ponds to the reservoir. The water from the artesian wells is drawn by air lift to a collecting basin and pumped to the mains with turbine pumps. Extensions to the system contemplated involve the laying of new mains at a cost of $73,000. The city will construct a new [illegible] cost of [illegible]

Niagara Falls, Ont.

Niagara Falls was incorporated as a town in 1881 and as a city in 1904. Its population, which stood at 8,000 in 1909, is now reaching the 12,000 mark, and its assessment of four and one-half millions five years ago has increased to $8,000,000. In 1913 the tax rate stood at 27.3 mills. The total value of building carried out last year was $500,000. There is a road mileage of forty, composed of brick, westrumite, concrete and macadam. An expenditure on road improvements estimated at $75,000 is contemplated this season. About two-thirds of the total area of the city is drained by brick and tile sewers, with four separate outlets into the Niagara River. Contemplated extensions include two miles of storm water sewers and three miles of main trunk sewers. Garbage is collected in wagons. The source of the water supply is the Niagara River, the waterworks system comprising two direct motor-driven centrifugal pumps of 3,000,000 Imperial gallons daily capacity; 1 triplex double-ended piston pump and one triplex plunger pump of 3,000,000 and 2,500,000 Imperial gallons respectively, driven by hydraulic power.

Ottawa, Ont.

The town of Ottawa was incorporated in 1847 and the city in 1854, three years after which it was proclaimed the capital of the Dominion by Her late Majesty Queen Victoria. In 1867, the year of confederation, the population was 18,700. This increased steadily until in 1909 it was 83,360, while to-day it is 101,000. Five years ago the assessment was $76,000,000, while in 1914 it is over $130,000,000. Last year's tax rate was about 19 mills. The total value of the building work carried out in 1909 was $4,500,000, while the 1914 estimate is $8,000,000, the corresponding figures for municipal engineering work being $400,227 (for 1909) and $800,000 (1914 estimate). The roadway mileage for the city of Ottawa is 154.29, the classification being as follows: asphalt, asphalt and stone block, tar macadam, tar macadam and stone block, stone block, bitulithic, bitulithic and stone block, wood block, tarvia X (modern type), macadam tar painted—a total of thirty-five miles of permanent pavements, the balance being ordinary macadam roads. The 1914 estimated expenditure on road work is $400,000, the greater part of which sum will be spent on asphalt roadways. The City Engineer, Mr. Archibald Currie, has prepared a report upon placing all streets within the city in good shape at a cost of over three million dollars. This report is now in abeyance. The sewerage is the combined system discharging into the Ottawa River. Disposal is by septic tank and dilution. The extensions planned comprise an intercepting sewer at a cost of $100,000. Garbage is collected under contract with the City Cartage Company, of Ottawa, and the city has one refuse destructor of the Heenan-Froude type. The installation of another destructor at the west end of the city is contemplated at a cost of $50,000. The water supply is from the Ottawa River, direct pumping by water and steam power being employed. The capacity is 32,000,000 Imperial gallons a day, with 2,232,000 gals. for the Hintonburg district. There are 160 miles of water mains in the city. The extensions planned comprise a complete new water supply, possibly from the Gatineau Lakes, at an expenditure of eight million dollars, and a distribution system at a cost of approximately one million. The electric light system is to be extended to the Hintonburg and Rideau districts.

Owen Sound, Ont.

The city of Owen Sound, which received its charter as [illegible] assessment is placed at $6,271,000 and the 1914 tax rate is 28½ mills. There are ninety miles of macadam roads at

Owen Sound, and the expenditure on road work this season is estimated at $10,000. The sewage is conveyed through brick and tile sewers on the semi-separate system and is discharged untreated into the bay. The garbage is collected by carts and dumped on the farm land. The city's water supply is from two gravity systems, the lower from springs and the higher from a spring creek, the maximum pressures being 70 lbs. and 104 lbs. respectively. Slow sand filtration is employed. A reservoir, with a capacity of 5,000,000 Imp. gals., is in use. The electric light system will probably be extended this season by connection with the Hydro-electric development at Eugenia Falls.

Peterborough, Ont.

Incorporated as a town in 1850 Peterborough received its charter as a city in 1905. Its present population of 22,000 represents an advance in the last five years of over 5,000. Its assessment for 1914 is $13,415,464, against $11,192,662 five years ago, and its present tax rate is 25 mills. The estimated value of building work which will be carried out this season is $550,000, and in addition the Engineering Department will be responsible for the expenditure of $250,000. The expenditure in the latter respect in 1909 was $55,000. The city's 55 miles of roadways consist of 2,300 ft. of asphaltic macadam on concrete base, gravel being used over the greater part of the city. The outlay on roadways this season will amount to about $100,000. The separate system of sewerage is installed, storm water being carried to creek and river. The sewage is emptied into the Otonabee River. An improved system is planned, this to consist of a new trunk sewer costing $30,000 and a sewage disposal plant, comprising sedimentation tanks, sprinkling filters and humus tanks, at a cost of $110,000. The garbage is handled by contract and disposed of in a 20-ton Reid incinerator. It is the intention of the city to double the area served during the present year. The water supply is drawn from the Otonabee River, water being pumped directly into the city mains by two single-acting triplex pumps, rated at 2,250,000 gals. a day, one pump of the same type of 3,000,000 gals. capacity and one centrifugal pump of like capacity, all of which are turbine-driven. Some ordinary short main extensions are contemplated for the present year.

Port Arthur, Ont.

Port Arthur was incorporated in 1884 as a town and as a city in 1907. Its population of 11,646 in 1909 and 18,025 in 1913 has grown to approximately 21,000 for the present year. Its assessment has trebled in the last four years, the amount under this read in 1913 being $33,443,960. The estimated value of building this season is $2,600,000, and of engineering work, $1,200,000. The city's roadways total 76.6 miles, classified as follows: paved streets, 4.4; rocmac, 2.5; macadam, 21.8; graded 37.9, the balance of 10 miles being unpaved. An outlay of $200,000 on road improvements is estimated for the present year. A partly combined system of sewerage (mostly separate) is in operation, the sewage emptying into Lake Superior. It is proposed to construct seven miles of trunk sewers, 14.5 miles of intermediate trunk sewers, pumping station and disposal works at a total cost of $2,500,000. The amount set aside for this year's work is $200,000 and for lateral extensions $80,000. The method of garbage collection is by wagons. The provision of a destructor is contemplated. The source of the water supply is Lake Superior, the system in operation being 20-in. intake, 12-in. force main, 10-in., 8-in., 6-in. and 4-in. distributing mains. Contemplated extensions of the system, to cost $550,000, are apportioned between a duplicate 24-in. intake pipe, duplicate 24-in. force mains and duplicate motor-driven pumps. The electric lighting system will be extended by mains and service lines at an outlay of $55,000.

St. Catharines, Ont.

This city has a population of 16,025 and its assessment is $10,874,000. The tax rate for 1913 was 22½ mills. The value of building operations for the year 1914 is estimated at $1,250,000, and the amount to be expended by the Engineering Department will reach $350,000. There are twelve and one-half miles of existing pavements, classified as follows:—bitulithic, 5½; asphalt block, 2½; asphalt, 1½; rocmac, 1½; brick block, 1, and westrumite ½. The contemplated expenditure on pavements this season is $150,000. The city has thirty miles of tile sewers—of various sizes up to 30-in. diameter—in operation, but no disposal works are as yet provided. Extensions to the sewer system for 1914 are estimated to cost $50,000. Stret cleaning and sprinkling are managed by the Works Department, and garbage is collected by contract and disposed of on dumps. A concrete high level bridge on Ontario Street, consisting of thirteen arches of 50 ft. span, will be completed this year at an ultimate cost of $140,000. This is constructed as a local improvement, to open up a sub-division of about 700 lots. The Engineer's report on a second high level bridge across the valley of the old Welland Canal, to connect the heart of the city with the western hill and the G. T. R. station, has been approved. Mr. N. S. Sprague, of Pittsburgh, Pa., has been appointed consulting engineer, and plans and surveys are in progress for the construction of a reinforced concrete viaduct 950 feet long, 80 ft. above water level and provided with a 30-ft. roadway and two 5-ft. sidewalks. The estimated cost of this structure is $175,000, with an additional $60,000 for cost of right-of-way. The bridge is expected to be built in 1915. Among the sewer extensions to be planned this year is a system for the Glen Ridge sub-division of 700 lots, with sewage disposal works and a relief sewer and duplicated outlet for the present main outlet sewer. The city possesses a gravity system of water supply, the source of which is Decew Falls. Extensive additions to the waterworks plant have been decided on at a total expenditure of over $50,000, apportioned as follows:—(1) installation of a sterilization plant at the reservoirs, automatically controlled by a 36-in. Venturi meter, estimated to cost $5,000; (2) the extension of distribution mains on new streets, 4-in. to 12-in., 23,000 ft., at a cost of $32,000; (3) service renewals and improvements on streets to be paved, $4,500; (4) new services estimated to cost $7,000; (5) improvements at reservoirs, $2,500. The city is installing a hydro-electric power and lighting system at a cost of $116,000.

St. Thomas, Ont.

This city, which received its charter in 1881, has increased in population from 10,000 in 1909 to 17,000 to-day, its assessment having grown in this period from rather less than $7,000,000 to nearly $10,000,000. The 1914 tax rate is 22½ mills. The building expenditure this year is estimated at $5,000,000 and the engineering expenditure at $80,000, these figures comparing with an actual outlay of $4,000,000 and $60,000 in 1909. The roadway mileage is 15½, the classification being brick, macadam, westrumite, tarvia, concrete and gravel. The expenditure on road work this season will be $40,000. The method of sewage disposal is by septic tanks. The city obtains its water supply from springs.

Stratford, Ont.

Incorporated in 1858 as a town and in 1885 as a city Stratford has increased in population from 14,500 five years ago to 17,000 to-day when its assessment is $9,900,000. The tax rate is about 25 mills. The building programme for 1914 is estimated at $7,000,000, while an expenditure of $125,000 is contemplated by the Engineering Department. The city has 65 miles of roadways, which are of clay and gravel, macadam, asphalt block, brick, westrumite, taralithic and tarvia, and

$40,000 has been set aside for road improvements this season. There are combined and separate systems of sewerage. The sewage is handled by septic tanks and sprinkling filters. Sedimentation tanks are to be provided at an estimated outlay of $25,000. The garbage is collected by private contract and burned. A systematic city collection and the provision of an incinerator are planned. The River Avon and artesian wells are the source of the water supply, which is distributed through the mains by electrically-driven and steam auxiliary pumps. Mechanical filters are in operation. The extension of the latter are contemplated. An improved system of electric lighting, involving an expenditure of $20,000, is planned.

Toronto, Ont.

Toronto—which, being interpreted, means "A Place of Meeting"—became a town in 1817 and a city in 1834. The population returns are interesting. In 1851 the population was 30,775; in 1856, 45,000; in 1871, 56,000; in 1881, 86,415; in 1891, 144,000; in 1901, 221,583; in 1910, 325,302, and to-day, 445,575. In 1871 the realty value was $22,037,470, a figure which had increased by 1881 to more than $42,000,000. Coming down to more recent times the assessment in 1909 was $227,800,000, while for 1914 it is placed at $516,489,032. The building estimate for 1914 is $27,000,000, while the expenditure in 1909 was rather more than $18,000,000. The outlay upon the various engineering enterprises of the Works Department this season will be nine million dollars, practically treble the amount expended five years ago. The city has 336.47 miles of paved and 185.06 miles of unpaved roads, a total of 521.53. The roadway classification is as follows: cedar block, 4.19 miles; asphalt, 183.80 miles; asphalt block, 6.51 miles; wood on concrete, .77 miles; macadam, 40.31 miles; bitulithic, 42.17 miles; brick, 28.11 miles; gravel, 11.54 miles; concrete, 8.61 miles, and asphaltic concrete, 1.23 miles. The expenditure on road work this season is estimated at nearly four million dollars. The sewerage is the combined system, the mains varying in size from 9 in. to 12 ft. in diameter. Upon the completion of the trunk sewer system all the sewage will be diverted to the sewage disposal works, which consist of sedimentation tanks, pumping and chlorinating plants. The sludge is pumped from the sedimentation tanks into a fenced enclosure in the immediate neighborhood. The effluent, after being chlorinated, passes by gravitation into Lake Ontario. Storm overflow sewers are now under construction at a cost of approximately $1,600,000, these having their outlets at the waterfront. In the way of extensions to the sewerage, a system of sanitary and surface drain sewers have been recommended for the recently annexed districts in the northern section of the city at an estimated cost of five million dollars. The garbage is collected by carts and deposited on dumps. Two temporary incinerators are in course of construction and a combined reduction and incineration plant is recommended at a cost of approximately $720,000. The city derives its water supply from Lake Ontario, the water being brought by gravitation from two intakes and intercepted at the Island, where it is subjected to filtration by the slow sand process. The waterworks extensions comprise the addition of a mechanical filtering plant with a daily capacity of 60,000,000 Imperial gallons, at an estimated cost of one million dollars, together with [illegible] tunnel shaft at a cost of $600,000; also extensions to the main pumping station to cost $360,000 and to the high level pumping station at a cost of $250,000, making a total expenditure of $2,210,000. A duplicate waterworks plant at the eastern portion of the city is also proposed at a cost of $5,400,000.

Windsor, Ont.

Incorporated as a town in [illegible], Windsor received a city charter in [illegible]. Its growth is emphasized by the fact that its population increased from 12,950 in 1902 to 16,142 in 1909, and to [illegible] in [illegible]. The population estimated for the present year is upwards of 25,000. The assessment last year was over twenty-one millions, while for 1910 it was rather less than twelve millions. Building progress is indicated by the following returns:—1909, $423,885; 1911, $739,515; 1912, $988,063; 1913, $1,048,975. During the first three months of the present year the building permits totalled nearly a quarter of a million dollars and the estimate for the twelve months is $1,500,000. The total expenditure on street paving and curbs, including renewals, is in the neighborhood of $850,000, the 1913 outlay having been $225,000. The city has about thirty miles of pavements, principally concrete and asphalt block. The estimated expenditure on paving this year is over $250,000. To date about $150,000 has been spent on silex stone walks. The expenditure for walks this year will be about $40,000. The total spent to date on sewers (mainly brick) is approximately $600,000, of which there was an expenditure of $185,000 last year. The estimated expenditure on sewer work during 1914 is upwards of $175,000. The garbage is collected by the city and is at present destroyed in a Walkerville incinerator, which has a capacity of 25 tons in twelve hours. The water system is direct from the River Detroit. Last year extensions thereto comprised a new intake and pumping plant. The 1914 extensions will consist of mains, valves, hydrants and specials at a cost of some $50,000. At present the Hydro-electric Commission are carrying on active work in anticipation of furnishing the city with hydro-electric power about July 1st. The announcement of the location of the United States Steel Corporation's plant at Ojibway is giving the constructional activities of Windsor a decided impetus.

Woodstock, Ont.

Incorporated as a town in 1850 and as a city in 1901, Woodstock has advanced in population from 9,600 five years ago to 10,154 to-day. The city's assessment at the present time is $4,804,920 and its tax rate 22 mills. The building programme this season is estimated to total in value $250,000 and the Engineering Department proposes to expend $11,000 this year—principally on sidewalks, sewers and macadam streets. Of the thirty miles of roads practically all are of macadam construction, half a mile being paved with brick. The sum of $5,000 has been set aside for road improvements during 1914. The sewerage is the combined system, with storm overflow, the method of disposal being septic tanks and filtration. Extensions to the system are projected at an estimated cost of $3,000, divided equally between the construction of a storm sewer and laterals. The city garbage is collected by contract and dumped. The water supply is from springs four miles distant. The pumping system is electrically-driven. Extensions to the electric lighting plant amounting to $10,000 have been planned.

(For Part II—Ontario Towns, Manitoba, etc.—See next issue.)

Sir Thos. Shaughnessy, president of the C. P. R., formally opened the great irrigation dam of the C. P. R. at Bassano, Alta., on April 28. The Bassano dam is said to be the largest in the world, it being longer even than the great Assouan dam.

It is estimated by Mr. Norman L. Harvie, secretary of the railways branch, that [illegible] miles of railway should be constructed in Alberta this season. It appears that over $11,000,000 is available in Alberta this year for construction of railways guaranteed by the provincial government. The work, which will probably be undertaken this year, includes [illegible] miles on the Peace River branch, [illegible] miles on the Edmonton, Dunvegan & B. C. line, [illegible] miles on the Alberta and Great Waterways road, 100 miles from Oliver to St. Paul de Metes, 175 miles from Calgary to Pincher Creek, C. N. R., together with about 200 miles of steel which should be laid this year on C. N. R. lines already graded in southern Alberta.

The Evolution of Sewage Disposal Methods in Canada

By T. Aird Murray, M. Can Soc. C. E.*

DURING the last six or seven years "sewage disposal" has become an important and much-talked-of problem in Canada, but even at this date, in spite of the advertising which the subject has had from the action of the provincial and other health authorities, very few people appear to have any but a hazy knowledge of what the problem really calls for.

Those who are connected with municipal government are recognizing that a new factor is rapidly developing in civic administration and that the construction of sewers can no longer be accompanied by the simple and economic expedient of discharging the raw sewer contents into the nearest natural drainage location which presents itself. Works of sewage disposal are being demanded by most provincial health authorities before legal sanction can be obtained for raising money by debentures for constructing new sewers, and in many cases communities are being notified that they will be required to install sewage disposal works in connection with several systems of old standing. As a rule the layman has some difficulty in mentally materializing exactly what this demand means, not only with reference to cost and construction, but more particularly as to what one can reasonably be expected to do with sewage in order to produce satisfactory results.

The Meaning of Sewage Disposal

The term "sewage disposal" has come to mean something more than the mere disposing of sewage. It implies that some method of treatment is included by which the disposal of sewage shall not be accompanied by any nuisance either to the community producing the sewage or to any neighbouring community which may be affected by the disposal. In brief, "sewage disposal" implies the construction of certain works calculated to alter the original character of the raw sewage, either by weakening it or changing its chemical character.

Sewage represents practically the water supply of a community after it has been used for cleaning purposes, flushing and carrying away the major portion of human and animal waste products. Sewage, therefore, chiefly consists of water, but the water contains varying amounts of organic matter in the form of suspended solids—solids in solution, and as chemical compounds, mineral matters and also numerous forms of bacteria, many of which are connected with specific diseases capable of transmitting infection. The development of the "water carriage system" by means of underground sewers for the removal of sewage, or "domestic drainage" entailed the concentration of sewage at the lowest topographical elevations, generally represented by a water-course or lake. Thus the custom developed in Canada, as elsewhere, of utilizing water-courses and lakes for the reception and disposal of sewage. The organic contents of sewage commence more or less rapidly to change in character immediately they are mixed with water. By processes known as putrefaction, fermentation and oxidation, the organic matters in sewage are gradually resolved into their elementary mineral constituents. The process of change from organic to inorganic takes place partly in the sewers and more particularly in the water-course or body of water eventually receiving sewage. When the proportion of water to organic matter is below a certain volume, foul odors from liberated gases result from putrefactive processes. Putrefactive processes, however, do not take place where there is a sufficient dilution of water to provide enough dissolved oxygen to oxidize the organic matters.

When dead or effete organic matter is mixed with water, the dissolved oxygen present in the water is gradually absorbed and not until it is absorbed does putrefaction take place. Domestic sewage entering a stream does not poison fish, but the sewage may be of such a volume as compared to the stream that the dissolved oxygen is used up and fish life made impossible. The process of sewage putrefaction taking place in a stream may render that stream as objectionable as an open sewer—foul-smelling, void of fish life, abhorrent and dangerous to cattle, and generally providing a nuisance very apparent to the senses. The same apparent nuisance may arise even when sewage is discharged into a large body of water, when the sewage is concentrated in a stagnant dock, bay or portion of the body of water not subject to currents or any cause producing dispersion. It is safe to say that Lake Ontario is capable of oxidising the organic matter of the sewage of many million people, but it is not safe to say that Lake Ontario can be utilized for that purpose, but only probably a very small area of the lake contiguous to the location of the point of sewage discharge. It is apparently very difficult to dispose or mix a volume of sewage with a large volume of water. The author has found areas of sewage-polluted water almost intact with lines of demarcation ten or twelve miles from Toronto Bay. It is more practical, at times, to disperse or mix sewage to the point of desirable dilution in a flowing river than in a lake.

The Esthetic and Sanitary Nuisance

The obvious nuisance due to odors, etc., from putrefactive processes when sewage is mixed with water is not the only or even the most important one. The study by bacteriologists of sewage-polluted waters has proven beyond all doubt that the infective bacteria which accompany sewage will continue in water long after the organic matter has apparently disappeared, and may be present even when the water appears as pure and sparkling as a glass of spring water. It is a demonstrated fact that the organic matter in the Buffalo sewage is mineralized in the passage down the Niagara River to the mouth, but that the water remains infected with colon bacilli.

The question of nuisance is a two-fold one. That which is apparent to the senses may be termed "esthetic" and the other "sanitary," the latter having a direct relation to health and the transmission of disease. It must be apparent that the amount and character of any sewage treatment may be subject to either or both of the above factors of nuisance. In the case of discharging sewage into tidal waters, neither of the above factors may apply. In the case of a small stream receiving sewage the water of which is not afterwards used for domestic purposes, the esthetic nuisance may be the only one requiring attention. On the other hand, with a large river, the proportion of dilution may be sufficient to obviate any esthetic nuisance, but the sanitary nuisance may be of a very grave and important character as in the case of the Niagara, the Ottawa, St. Lawrence, Saskatchewan and other large rivers, which are utilized for domestic water supply.

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Sewage Disposal With Reference to Canadian Conditions

The amount and even character of sewage treatment is not by any means a fixed factor of general application. There is no one defined complete system of sewage disposal which is the only or the best system capable of general adoption. Sewage treatment cannot be unified in the form of an exact machine, subject to exact cost per capita either for capital or operation charges. A system of a particular character may be efficient under certain conditions meeting certain defined requirements, however, allowing different conditions and requirements, the same system may be either efficient or a wanton waste of money. Local conditions, character of sewage with reference to trade effluents, etc., amount of treatment required, character of stream or body of water receiving the sewage, topography, locality and site for works are all determining factors upon the choice of any particular method and amount of treatment. It is not surprising then to find that the layman is at some trouble in arriving at an understanding as to what sewage disposal really means. The elasticity of method with reference to meeting varying requirements is the reason for this branch of engineering being specialized and confined to the judgment of experts trained particularly in the work. It is difficult to estimate the proportionate value of chemical and engineering knowledge required in order to produce an efficient system of sewage disposal to meet any one set of special requirements. Certain it is, however, that the chemist has done much of late years to explode many unsound theories and put the subject upon a more scientific and certain foundation. The research and experimental work which is being done by many of the health officers and chemists connected with the provincial government of Canada is having its effect already in producing a very advanced and efficient class of work compared with the old, so-called, "septic tank," which up to within a few years ago was considered by engineers and the people generally as the whole thing in sewage disposal.

The Canadian Society of Civil Engineers appointed a committee in 1910 to investigate the question of "sewage disposal" with reference to the pollution of lakes and streams in Canada, and a report was submitted at the Annual Meeting in 1911. The Committee addressed a list of questions to 327 places in all, with the result that the Maritime Provinces, Quebec and Manitoba reported no sewage disposal plants. British Columbia reported one place with septic tank treatment. Ontario reported nine places with septic tank treatment only, four with septic tanks and bacteria beds, one intermittent sand filter, and one with treatment on land. Saskatchewan and Alberta each reported one place with septic tanks and a few places at which modern processes were contemplated at an early date or actually under construction. Since 1910, Alberta, Saskatchewan and Ontario have seen the completion of several up-to-date completed sewage disposal works and several other works are under construction or are proposed at the present time.

It may be taken that public opinion in Canada is in line with reference to the advisability of non-infection of inland waters with sewage bacteria. Several remarkable typhoid epidemics occuring in cities and towns within the last few years have been demonstrated to result directly from the use for domestic purposes of sewage-polluted water. Montreal, Ottawa, Toronto, Fort William and Sarnia have suffered terribly in the past, while the death rate per 100,000 from typhoid throughout the Dominion has been about six times greater than in Great Britain. The use of calcium hypochlorite during the last three or four years in connection with many known polluted water supplies has done a great deal to reduce typhoid. At the same time there appears to be a general feeling of exasperation that the use of chemicals should be necessary in order to provide safe water supplies. That "prevention is better than cure" is a sound axiom and will always be a popular one. Wherever provincial boards of health have taken up the subject of prevention of pollution of water supplies with sewage, their efforts have, generally, been popular with the public. In cases, however, of inter-provincial and international waterways, provincial governments have met with a difficulty in administering laws regulating pollution. For instance, the laws with reference to the restraint of sewage pollution are much more effective in Ontario than in Quebec. Ontario can only administer on one side of the Ottawa River, the other side being controlled by Quebec. In connection with our international boundary waters, towns and cities on the Canadian side hesitate to spend money in sewage treatment works unless there is some guarantee that the towns and cities on the American side follow suit.

Evidence that popular opinion is directed to the above conditions is apparent in the fact that the Parliament at Ottawa are directing their attention to the framing of Dominion legislation calculated to prevent the pollution of interprovincial rivers, while the "International Waterways Committee" have been asked by their respective governments to advise as to what measures should be taken jointly to prevent the pollution of boundary waters. It is understood that a large amount of evidence is being collected which points to the necessity of immediate action, and municipalities may anticipate with certainty that it will shortly become a civic crime to utilize inland waterways, such as streams, rivers and lakes, for the purpose of sewage purification. In the great majority of cases, sewage will have to be treated not only to obviate the esthetic nuisance, but further to eliminate or destroy the sewage bacteria. The statement that cities and towns may filter and chlorinate water supplies will not serve as an answer to the general demand for prevention in the first instance, because it will always be impossible to filter and chlorinate all water supplies taken by individual farmers, used for stock and dairy farming purposes, used by the summer cottages and the lake or river floating population. It is an indisputable assertion that **if the domestic sewage which now discharges by means of underground sewers direct into streams, rivers and lakes without any form of treatment were treated to the extent of the elimination and destruction of the sewage bacteria, at least fifteen hundred lives could be saved annually in Canada from death by**

Sewage Disposal Works, Weston, Ont. Sludge separator tanks and filters covered in.

typhoid alone and this only entails cutting the typhoid death-rate by one-half, yet practically leaving it double that of Great Britain.

British and Canadian Conditions Compared

The elimination of sewage bacteria or the prevention of the "sanitary nuisance" is of more importance in Canada than in Great Britain, and British methods of "sewage disposal" are only partly applicable to this country. In Great Britain, water supplies are not generally taken from sewage-polluted sources, but from upland surface collecting areas devoid of population. The chief purpose of sewage disposal in Great Britain is to avoid the esthetic nuisance and to preserve fish life. The chief purpose of sewage disposal in Canada is to avoid the sanitary nuisance and to preserve our water supplies as pure as possible from sewage infection. Canada is dependent upon its lakes and rivers to a great extent for water supply. Continued droughts, comparatively speaking low average rain precipitation, hot sunshine in the summer months tending to algae growths in impounded waters, ice covering in winter retaining the gas products of decaying vegetable growth, are all factors which put our water supply conditions on an entirely different footing from those of Great Britain, and in many cases dictate a method of sewage treatment in advance of that generally accepted in Great Britain. For example, the rivers "Don" and "Humber," near Toronto, with their extensive water-sheds would be large rivers in Great Britain, with its generally impervious surface strata and high average rain precipation. These rivers with their large collecting surfaces would form ideal catchment areas for the impounding of water, which under British climatic conditions would vary only slightly in temperature and show decided improvement in the quality of the water the longer it was stored, allowing of sedimentation and exposure to the oxygen of the atmosphere. But practically only during the spring freshets and melting of the snow and ice is there any water to speak of flowing in these rivers. During the summer months they are practically a succession of stagnant pools, the summer rains being absorbed by the friable sandy soil of the uplands and never reaching the river courses. It is for the above and other reasons that Toronto cannot depend upon its water shed to the north for water supply, but must utilize Lake Ontario water, which in turn receives the sewage of its whole population. Toronto is face to face with the problem of destroying the sewage bacteria before the sewage enters the Lake.

Chief Features of Sewage Disposal

Sewage, as has been stated, is water containing organic solids in suspension, organic matter in liquid form either as a solution or chemical compound, and sewage bacteria. There are thus three distinct classes of objectionable ingredients in sewage each of which requires a separate character of treatment, viz., organic solids, organic liquid and bacteria. If the sewage is allowed to enter a lake or a slow running stream, a large proportion of the solids settle by gravity to the bottom, where it gradually rots, a proportion of the solids floating to the surface. The liquid organic

Sludge separator tanks, Weston, Ont. One unit empty.

Sludge separator tanks, Weston, Ont. One unit full.

matter gradually mixes with the water and is oxidized if sufficient dissolved oxygen is present; otherwise it sets up putrefactive conditions. The sewage bacteria gradually die out, but may maintain their vitality for several weeks. Essentially sewage treatment is in line with the first two of the above processes. The solids are separated by gravity and the liquid organic matter is oxidized. The bacteria, however, are not allowed to die at their leisure, but are eliminated by disinfection. The resultant liquid, freed from solids, incapable of further putrefaction and free of sewage bacteria, may then be turned into a stream or lake with impunity. The trouble in the past has been how to efficiently obtain the desired result without nuisance, and without too great a cost commensurate with the results.

The Septic Tank

The old 'septic tank" has suffered more from exaggerated claims which engineers put forward with reference to its supposed capabilities than it should have done if its limitations had been thoroughly understood. A septic tank is nothing more, and can be nothing more, than a tank or receptacle in which the suspended solids in part settle to the base of the tank and in part float upon the surface. The tank in its operation did not oxidize the organic matters in solution, or so change the liquid sewage to an extent to obviate the esthetic nuisance attending its final discharge. The sewage bacteria were not eliminated, and under the most favorable conditions the discharge remained sewage, in most cases providing foul odors which were not even appreciable with the fresh sewage entering the tank.

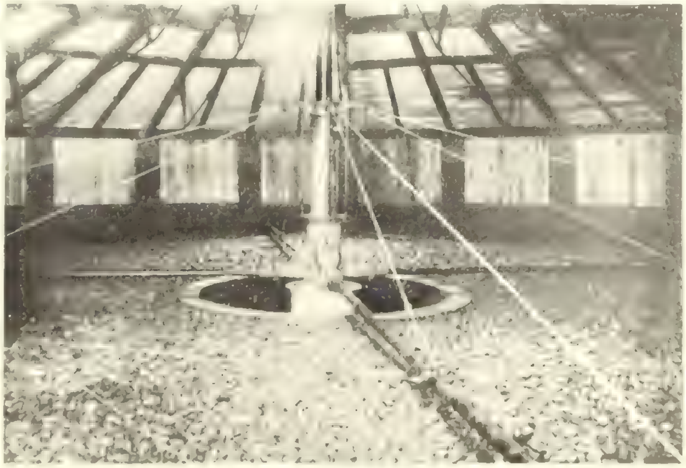
The original claim by the patentees of the septic tank was simply that the organic solids retained by gravity in the tank, if allowed sufficient time, would by a putrefactive process rot to the extent of elimination, and thus the visible matters in sewage could automatically be dealt with. This claim, however, has been only partially met in practice to the extent of about twenty to thirty per cent. elimination of the retained solids. The septic tank has proven itself an inefficient machine for even the purpose for which it was designed. On the other hand, the principle of its action upon solids is the basic principle of the newest type of sewage settling tanks.

Upon the publication of "The Fifth Report of the Royal Commission on Sewage Disposal," in which the limitations of the septic tank were precisely demonstrated, it became apparent that the failure of the tank as a separator of suspended solids lay in the principle of construction, by which the settled solids while undergoing putrefaction were constantly in contact with the fresh flowing sewage, and that if the solids immediately upon settlement could be removed from the settling basin to a separate tank many of the inherent objections to the septic tank could be obviated.

The Modern Sludge Separator Tank

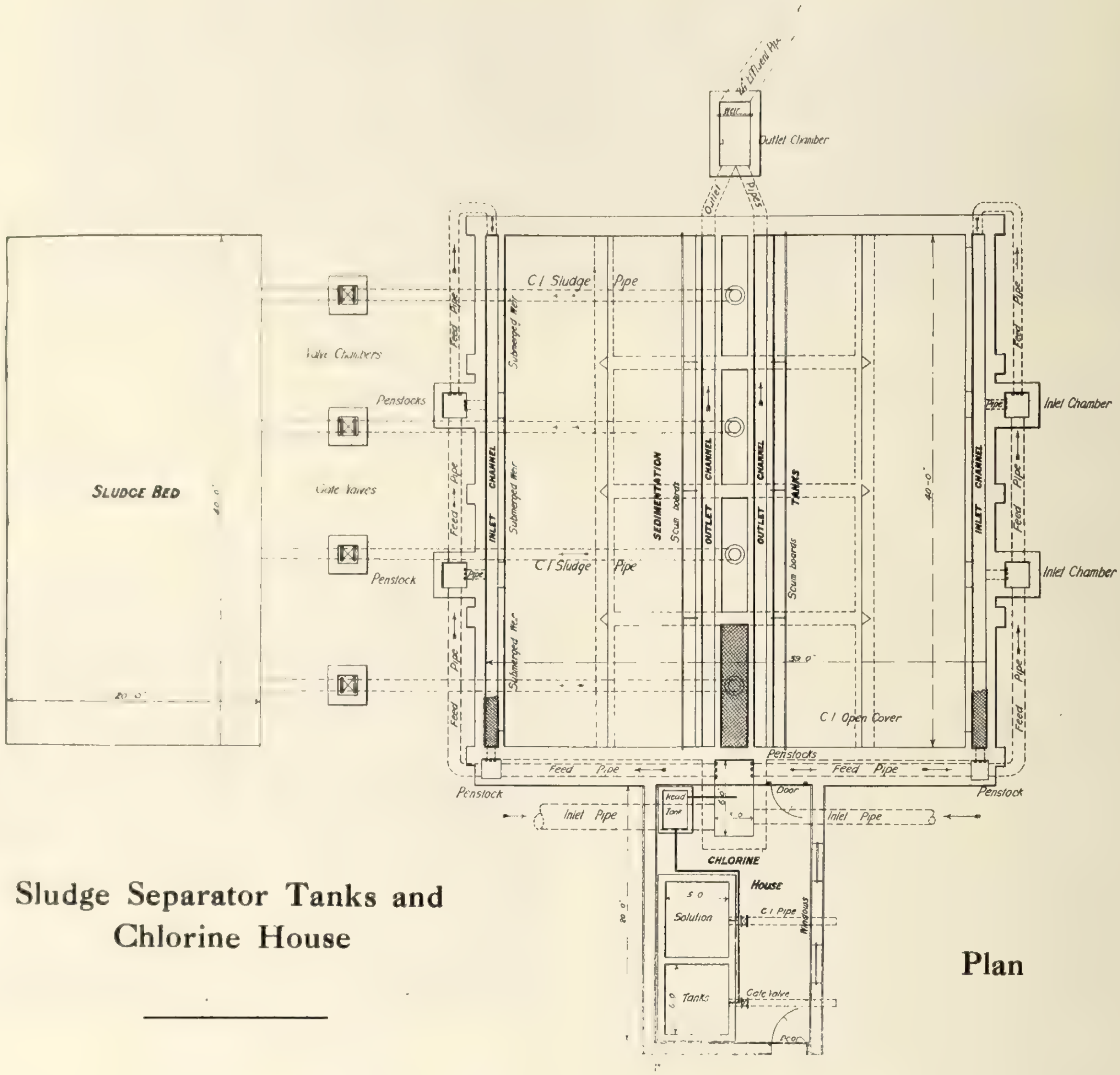
The old septic tank is really the father of the modern "Sludge Separator Tank" or "Two-Storey Tank," as it is sometimes called, the solids of the sewage being retained and allowed to rot by the natural process of putrefaction. Dr. Travis of England, and Imhoff, of Germany, were among the first to introduce "Sludge Separator Tanks" in Europe, while Rudolph Hering has taken the matter up very strongly in the United States. The first "sludge separator tank" on the two storey principle installed in Canada was designed by the author in 1910 for the city of Lethbridge, Alta. The principle of the "Sludge Separator Tank" is now generally accepted by engineers and health authorities as an efficient machine for the retention and treatment of the suspended solids in sewage and although the construction lends itself to variety in design in minor points, the principle of immediate removal of the precipitated solids to a separate chamber and from contact with the continuous flowing fresh sewage is common to all.

One of the illustrations shows a plan and section of an improved "sludge separator tank" of the rectangular type, representing, generally, the design now adopted by the author. The unit consists of duplicate settling basins capable of dealing with the sewage of from three to four thousand population. The sewage is shown to enter first a chlorine treatment chamber from which it is conveyed by feed pipes to an inlet channel baffled by a submerged weir. The weir is carried along the full length of the tank and the flow is directed across the narrow width of the tank to an outlet channel near the centre. The cross section through the tank A to B shows the submerged weir, outlet baffle or scum board, and outlet channel, together with the triangular section used as a settling basin. The velocity of the sewage flow is reduced to almost quiescence in its passage through the settling basin. The settling solids pass through the opening at the base of the settling chamber into the separate sludge storage area, which is common to both settling basins. The sludge storage area is open to the surface for the whole length of the tank to a width of about two feet six inches providing ventilation and control. The cubic area for sludge storage is equal to about four months' collection of solids, this being considered a sufficient length of time to allow of thorough putrefaction. During the process of putrefaction, the gases or products cannot come into contact with the fresh-flowing liquid sewage. The solids are periodically removed from the tank by opening the valve shown and the pressure due to the head of water in the tank above the sludge outlet forces the sludge to drying beds constructed alongside the tank. The resultant sludge from storage basins, constructed as shown, is odorless and when allowed to dry in beds resembles earth humus.



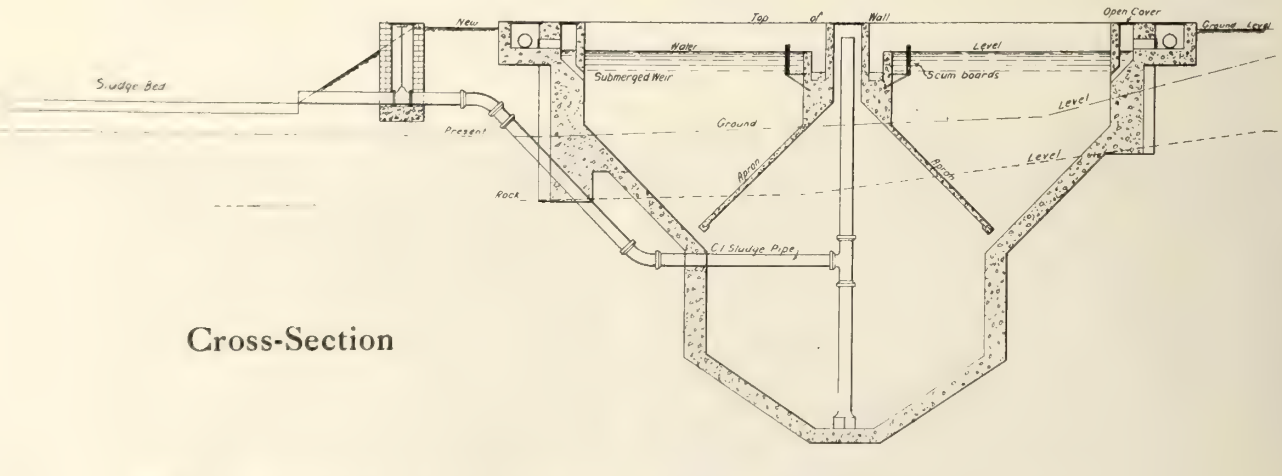
Sprinkling filter, Weston, Ont.

An interesting feature in connection with the tank as illustrated is that the chlorine is applied before the raw sewage enters the settling tanks, and not afterwards, as is generally the custom. It has been dem



Sludge Separator Tanks and Chlorine House

Plan



Cross-Section

The Evolution of Sewage Disposal Methods in Canada.

Lethbridge Sewage Disposal Works. Sludge separator tanks and filters under construction.

onstrated by the experts employed by the Provincial Board of Health of Ontario at their experimental station that it requires less—or at least no more—chlorine to disinfect the liquid sewage before it enters the tank than after, and that the lime acts as a precipitant upon the solids. The theory appears to be based upon the principle that fresh liquid sewage requires less chlorine than when stale and that the object should be to bring chlorine into contact with the fresh sewage liquid as early as practicable. The solids are, of course, not disinfected and settle with their contained bacteria to the storage basin. In treating water for domestic supply with calcium hypochlorite, it is necessary to settle out the lime before introducing the chlorine, but with sewage both the chlorine and the lime may be added together and so the well-known precipitating value of the lime is utilized in obtaining a greater percentage of settling solids than might otherwise be the case.

Assuming that three parts per million of free chlorine are necessary to disinfect the liquid sewage and the chloride of lime contains 33 per cent. of free chlorine, then it would require 9 lbs. of chloride of lime for every 1,000,000 lbs. of sewage, or 90 lbs. of chloride of lime for every 1,000,000 gallons of sewage. This means that 60 lbs. of lime can be utilized to aid precipitation, which is otherwise a waste product if disinfection is applied as a final treatment.

The liquid effluent from these tanks may ordinarily be turned into a stream or body of water, when the dilution is greater than one volume of liquid sewage to thirty of water, without creating any esthetic nuisance. The velocity of flow in a steam, and the efficiency of the method of obtaining dispersion of the liquid sewage in order to obtain the maximum amount or dilution at once, are important factors for consideration. The amount of solids which are settled out average about from 80 to 90 per cent. of the solids which are capable of settling and from 60 to 70 per cent. of the total suspended solids. The effluent continues to contain a proportion of the finer solids, especially those of a specific gravity practically equal to water, which, although not visible in the effluent, will in a small stream form objectionable deposits.

Modern Sprinkling Filters

When it is desired to obtain a liquid effluent which is no longer organic in the sense that it is subject to putrefaction, and which will practically make no demand upon the dissolved oxygen of the water receiving the effluent, the sewage liquid from the tanks may be oxidised by passing it through what are termed "sprinkling filters." There are several installations of

Lethbridge Sewage Disposal Works

Under drains and distributor for filter

Lethbridge Sewage Disposal Works

Sludge separator tanks and filters complete with [illegible] these filters both in eastern and western Canada and in spite of the severity of our winters they have proved efficient. The filters are composed of a depth of about six feet of broken stone, slag or other hard material of a rough character averaging in size usually from one to two inch cubes. The rate of filtration at six feet in depth may for ordinary domestic sewage be at about two million gallons of sewage per acre per day, depending, however, upon the organic strength of the sewage as represented by the number of persons connected with the sewers.

The liquid sewage is sprayed over the surface of the filter and percolates slowly to the base, which is very thoroughly drained to the centre. The voids of the filter material are from 50 to 60 per cent. of the cubic area. Not more than 20 per cent. of the voids should at any time be taken up with sewage, the remaining 30 per cent. being taken up with air. The liquid sewage in passing through the filter comes into contact with the oxygen of the air, absorbing it, the character of the organic matter being changed and rendered inoffensive. The fine suspended matter not retained by the settling tank is caught by the surfaces of the filtering material and as it is mineralized it is washed away through the underdrains and generally allowed to settle out by aid of a final settling tank called the "Humus Settling Tank."

Lethbridge Sewage Disposal Works.
Filters operating in winter and giving efficient results.

A Complete System of Sewage Disposal

It will be seen from the above that a complete system of sewage disposal may consist of (a) "Sludge Separator Tanks" removing the bulk of the suspended solids; (b) "Oxidizing Filters" for the treatment of the liquid sewage; (c) "Humus Settling Tanks" for the removal of the finer suspended matters caught by the filters and given off by the underdrains, and (d) Chlorine treatment for the final disinfection of the effluent. There are cases where the requirements may only call for "a," for "a" and "b," or for "a" and "d," and municipalities must rely upon expert advice in this connection. Two complete sewage disposal installations in Canada have lately been the object of several visiting deputations from other municipalities, viz., Weston, near Toronto, and Lethbridge, in Alberta. It is well for those administering civic matters to make themselves acquainted with the practical working parts of an installation before going into the matter. Much is gained by a visit to works where the whole principle can be explained and the results seen and demonstrated. The cost of sewage disposal varies considerably per capita, depending upon the availability of the site, and the amount and character of treatment required. At Weston the plant as constructed will deal with the sewage of 5,000 population at a construction cost of $3.40 per head. At Lethbridge the capacity is for 20,000 population and the cost $3.00 per head. In both cases the system is complete, but pumping is not necessary, and the sites are ideal for the purpose. As a height of from eight to ten feet between the outlet sewer and the effluent discharge is required in order to treat sewage by "a," "b," "c" and "d," as above described, in many cases low lift pumping is a necessity. When "a" and "d" only are required—that is, when the filters can be left out—a height of two feet is ample. The combination of "a" and "d" is, therefore, more applicable to municipalities located with lake frontages.

Sewage disposal will eventually be found not such a costly item as is generally feared, if due consideration be given to actual requirements.

With regard to the question of nuisance from "disposal works," it may be taken and fully demonstrated by modern works at present installed in Canada that there is no odor or nuisance perceptible, and that the fear of nuisance is altogether based upon sentimental notions.

The Meter System as a Preventive of Water Waste

By Herbert J. Bowman, M. Can. Soc. C. E.*

ENGINEERS have long recognized the great difference between the quantity of water required to supply cities and towns in America and that found sufficient in Europe. The truth is that there is an enormous waste of water in this country and it is high time that municipal authorities woke up to the fact. Instead of continually adding to the pumping machinery, what is required is to stop this waste.

The day is coming when every city and town will be required to purify its sewage and not contaminate the streams and lakes, and the first step should be to keep down the quantity of sewage to be treated. This can be done without lessening the amount of water used for flushing the sanitary appliances, or curtailing the legitimate use of water in any way. In the average Canadian city, 50 gallons of water per head of population per day is ample for all purposes if waste is avoided. This is considered a generous supply in Europe and a few places in America have discovered how to manage with this amount. Toronto, Buffalo, Detroit and other cities are daily pumping from 100 to 200 gallons per head. The chief reason for water waste is leaky plumbing fixtures. Of course (in some waterworks systems, much water is wasted by leaky joints in the mains, but where the management is up-to-date this loss of water is being detected and stopped. The great water-waster, after all, is the ball-cock in the closet tank. Although there are often kitchen taps that waste a great deal of water, this waste is easily seen and if the consumer has any conscience at all he will have the trouble attended to.

Now how is this waste to be prevented? In the old country it is done by allowing nothing but the best plumbing fixtures to be used and having frequent house-to-house inspection to see that they are kept in order. Indeed, in some cities the corporation keeps the plumbing fixtures in repair, and all the consumer need do is to telephone to the water-works office and a man is sent to stop the leak. Then in the countries of western Europe there is a better observance of law than we have in the New World, which accounts to a large extent for the ability of their water-works authorities to prevent water waste. In addition to this, labor is cheap in Europe and plumbers' bills are not so high.

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* Of Messrs. Bowman and Connor, consulting engineers, Toronto and Berlin, Ont.

In America, the best way to prevent water waste is by selling the water, by the gallon, by meter measurement. Many places in the United States and a few in Canada have found this out. Among the latter is the city of Berlin, Ont., where there are 2,917 metered services and only 485 on the flat rate. The latter are limited to small houses having only a kitchen tap. As a result we have a city of 18,500 inhabitants supplied by an average pumping of one million gallons a day. Berlin is noted as an industrial centre and all the factories use city water, there being no other supply. The water pumped on Sunday averages only about 700,000 gallons, so the domestic use is about 40 gallons per head per day and the total consumption of water for domestic and manufacturing purposes runs only a little over 50 gallons per head per day. Having a limited supply of artesian well water Berlin had to make the most of it and for the last twenty-five years we have been using more and more meters until now over 85 per cent. of the services are metered. Ever since the establishment of the sewerage system, over twenty years ago, we have been treating our sewage. At first it was accomplished by broad irrigation on land, but now it is held in septic tanks and then pumped to filter beds. If water waste were not prevented, this could not be done except at a largely increased expense. As it is, Berlin's tax rate is no higher than many other cities that run their raw sewage into the rivers to make trouble for other places below. The municipal authorities do not claim any great credit for treating their sewage in Berlin as there is only a very small creek running through the town. When the broad irrigation beds were overworked some years ago, the farmers along the creek began action for damages, with the result that they collected about $10,000. The corporation then put in the most modern system of sewage disposal appliances.

A typical case of water waste is shown by the following figures taken from the meter register:—

Service No. 2386		Consumer Dr. K———	
March Qtr.	6,250 gals.	at 18c per M.	$1.13
June Qtr.	9,375 gals.	at 18c per M.	1.69
Sept. Qtr.	229,375 gals.	(special rate)	18.16
Dec. Qtr.	8,125 gals.	at 18c per M.	1.47

Here you will notice an enormous amount of water passing through the meter in the September quarter. This was found to have been caused by a defective ballcock in the closet tank. At the ordinary rate for house consumption the bill would have been over $40. This, however, would have made the fine too heavy, so a sliding scale to cover such mishaps has been arranged and the bill paid was $18.16, quite sufficient to make the consumer send for a plumber the next time he sees or hears a leak. However, it is not often that these big bills have to be paid, as the consumers know what the result will be if they are careless. Indeed, the meter system is very popular in Berlin, as the careful consumer with an average-sized house gets off with the minimum water rate of $4.[illegible] a year and has no meter rent to pay.

Another great advantage of the meter system is the equitable water rates that we have. Instead of a flat rate based upon the size of the house, or some other unsatisfactory assumption, the consumer pays exactly for what he gets. To illustrate, the Berlin water rates are given below, the flat rates being given first. All other services are metered.

Kitchen use	$5.00
Stable, one horse	3.00
Each additional horse	1.00
Cows, each	1.00

(Subject to 20 per cent. discount)

Berlin Meter Rates

Up to 1,500 gallons per day, per 1,000 gals.	18c
1,500 to 2,000 gallons per day, per 1,000 gals.	17c
2,000 to 3,000 gallons per day, per 1,000 gals.	13c
3,000 to 4,000 gallons per day, per 1,000 gals.	11c
4,000 to 5,000 gallons per day, per 1,000 gals.	10c
5,000 to 6,000 gallons per day, per 1,000 gals.	9c
6,000 to 8,000 gallons per day, per 1,000 gals.	7½c
8,000 to 10,000 gallons per day, per 1,000 gals.	6½c
Over 10,000 gallons per day, per 1,000 gals.	6c

Recently the Berlin Water Commissioners constructed a new concrete reservoir and concrete water tower and put in new electric pumps. Two turbine pumps were installed, each having a capacity of 800 gallons a minute, one of these being able to pump all the water required. Contrast this with some of the other small cities where they have pumps of a capacity of four and five million gallons a day, necessitated by the waste of water. Water-works officials studying the meter system, will find the Berlin Water-Works superintendent glad to be of any assistance.

A Word About the Annual Number

THE Annual Number of a technical or trade publication must have some particular significance. The day has long since passed when any excuse is accepted for a "special issue." Reading has become specialized; advertising has become specialized. Neither the reader nor the advertiser is easily gulled.

The Annual Number of the Contract Record and Engineering Review has become an established institution. Its appearance coincides with the first real flush of constructional activity. It is designed to show the engineer, the architect, the contractor, the manufacturer, something of the possibilities of the field, something of the development that is taking place, something of the progress that is being made technically. It is not intended to enrich the publisher beyond the bounds of avarice, as the casual observer is only too ready to surmise in glancing over the announcements of more than two hundred progressive advertisers. Its main object is to serve a useful editorial purpose. Upon no other fundamental basis can the standard of a publication like the Contract Record and Engineering Review be maintained and improved. The Annual Number of this journal is for the reader.

While we do not wish to fall under the heinous ban of the commonplace, we cannot refrain from congratulating ourselves upon a policy which has produced the results evidenced in this issue, both from an editorial and an advertising standpoint. That policy has been to attain a higher mark year by year.

The reader will not think that we are unduly elated, we trust. Doubtless he will find many shortcomings in glancing over the pages of this issue, and assuredly we can show him some that he will otherwise overlook. But the results cheer us. The field ahead attracts us. The possibilities of future attainment are alluring. Canada speaks.

Recent Extensions to City of Hamilton Waterworks System

By W. Hollingworth, A.M. Can. Soc. C.E.*

OWING to the rapid growth and to the annexation of large areas to the city, it was found necessary in 1912 to increase Hamilton's water supply system so as to provide an adequate supply with constant pressure for a population which at present is 110,000, and also to provide facilities for expansion. The present daily consumption per capita is 100 Imp. gal. In 1913 provision to the extent of $650,000 was made for extensions, which comprise: 48-inch intake pipe in Lake Ontario; 48-inch conduit to pumping station; 36-in., 30-in., 24-in., 20-in. and 18-in. rising mains; electrical pumping station at Beach; electrical pumping station for high level and Mountain pumping system, with rising main and elevated tank for Mountain pumping system.

48-in. header, showing two 30-in. intersecting rising mains with controlling valves.

The city's water supply is taken direct from Lake Ontario. The only opening from Burlington Bay to the lake is at the canal, 3¼ miles distant from the intake pipes, thus obviating any possibility of pollution from the water of the bay. The city may be said to have one of the purest sources of water on the continent, the typhoid death rate for 1913 being only 10 per 100,000 of the population.

Historical Data

The first water works system was constructed in 1857, the source of supply consisting of a settling basin parallel to the lake shore, the water from the lake percolating through the banks and being conducted through a 33-inch wood stave conduit to the pumping station 2,000 ft. distant. The pumping station consisted of two 100 h.p. beam engines, constructed by Mr. John Gartshore of Dundas, Ont., with a combined capacity of 3,300,000 gals. per twenty-four hours. (In 1880 they were enlarged to 5,250,000 gal. capacity) These compound engines, which were the first built in Canada at a cost of practically $96,000, are still retained as an emergency unit. As the consumption of water increased it was found that the percolation of water into the settling basins was insufficient to give the required amount. In 1871 a wood stave intake of 36-in. diameter, was laid through the bank 200 ft. into the lake. In 1876 the settling basins were extended to 2,724 ft. in length by 78 ft. wide and 16 ft. deep, and an additional 36-inch wood stave conduit laid therefrom to the pumping station. In 1886 two additional steam pumping units were installed with a combined capacity of 8,000,000 gallons per twenty-four hours. Again in 1889 the infiltration into the basins together with the short 36-inch intake, was insufficient, on account of low lake level, to give the required quantity of water and a second intake, 850 ft. long of 20-inch cast iron pipe, was laid through the bank into the lake.

In 1910 two electrically-operated turbine pumps were installed with a combined daily capacity of 12,000,000 gallons. The first rising main constructed with the original system was of 18 inches diameter discharging into a reservoir of 11,000,000 gallons capacity, the surface elevation being 187 ft. above Lake Ontario. The 18-inch main was paralleled in 1881 with a 20-inch main, and in 1901 with a 30-inch main. In 1904 a new reservoir was constructed at an elevation of 60 ft. higher than the existing one, of a capacity of 3,000,000 gallons. The old reservoir was then cut off from the system and is now used as a storage reservoir, being held in reserve for emergencies, giving a gravity supply in the event of breakdown at the pumping plant. The head at present pumped against is that of the 3,000,000-gal. reservoir. This is merely a compensating reservoir fluctuating with the city's consumption, and the system may be looked upon as a direct pumping system.

In addition to the main pumping plant there are two re-pumping plants, one for the high level district raising the water to the high level reservoir, sixty feet higher than the compensating reservoir; and the second raising water to the mountain top, 267 ft. higher than the compensating reservoir. Until the time of the waterworks extensions these latter two plants were separate but under the new system these have been combined in one building.

A forty-eight-inch intake pipe was constructed of 7-16-inch steel plate, single rivetted on the circumferential seams and double rivetted on the longitudinal seams, and were shop assembled in 29-foot lengths, then field assembled into lengths approximately 142 ft. long. Rolled steel angles 4-in. x 5-in. x ¾-in. thick, with welded ends, were rivetted to each end. Expansion joints with circular lead gasket in the slip joint were placed at intervals of approximately 600 ft. The total length of the intake pipe is 2,144 ft., and extends from the settling basins directly into the lake, being placed in a dredged channel so that no part of the steel pipe projects above the bottom of the lake. Twenty feet on each side of each joint pile bents are placed to carry the pipe. These pile bents were included in the construction of the work more to keep the pipes at proper grade during laying and bolting than to be of any support after the dredged channel was filled in.

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*Assistant City Engineer, Hamilton, Ont.

There is practically no scouring action or movement of the sand at this part of the lake.

The pipe is kept below the bottom of the lake for its full distance as the ice in winter occasionally piles up to great heights. The trouble with the original short intake was that the weight of ice would block the crib and pipe. Where the fill on the top of the pipe exceeds 10 ft., concrete in bags is placed around the pipes to prevent deformation, through weight of fill. Joints between flanges are made of corrugated lead and asbestos, similar to that used for steam pipes, with satisfactory results. At the extreme end of the intake in 28 ft. of water an intake crib is placed 24-ft. x 24-ft. x 24-ft. high, built up of long-leaf southern pine, with four corner pockets for stone filling. The screens on the top are constructed of 2-in. x 6-in. white pine laid on edge. This method was adopted to prevent the formation of anchor ice, no iron being exposed on the crib except the heads of bolts.

In constructing this work a sufficient length of channel for one length of pipe only was excavated at one time, piles driven, and pipe bulkheaded and floated near the position in which it was finally to rest. It was then sunk and secured under pipe laying scow, floated over pile bents, dropped and bolted up by divers. Pneumatic tools were used for cutting off piles, drilling for drift bolts and other sub-aqueous work. The plant used comprised a pipe-laying scow with shackles at each end, from which the pipe was suspended (this scow contained a compressor for divers and pneumatic tools), a scow with clam shell for excavating, and an attendant tug. The contractors for this work were the John W. Danforth Company, of Buffalo, New York.

A 48-inch conduit was constructed of concrete pipe reinforced with triangle wire mesh to standard designs of concrete manufacturers. The concrete was mixed in the proportions of 1-2-4, and water-washed gravel and sand used throughout. The pipe is laid approximately 11 ft. below zero lake level and is required to stand internal pressure when working. To obtain a watertight construction and prevent settlement of pipes and breaking of joints after the pipe was laid, the annular space between outside of pipe and side of trench was filled in up to the springing line of pipe with wet concrete which worked well under the pipe. This conduit, the length of which is 1,890 ft., was constructed by the John W. Danforth Company.

Crib to 48-in. intake pipe (unfinished)

Caulking With Pneumatic Tools

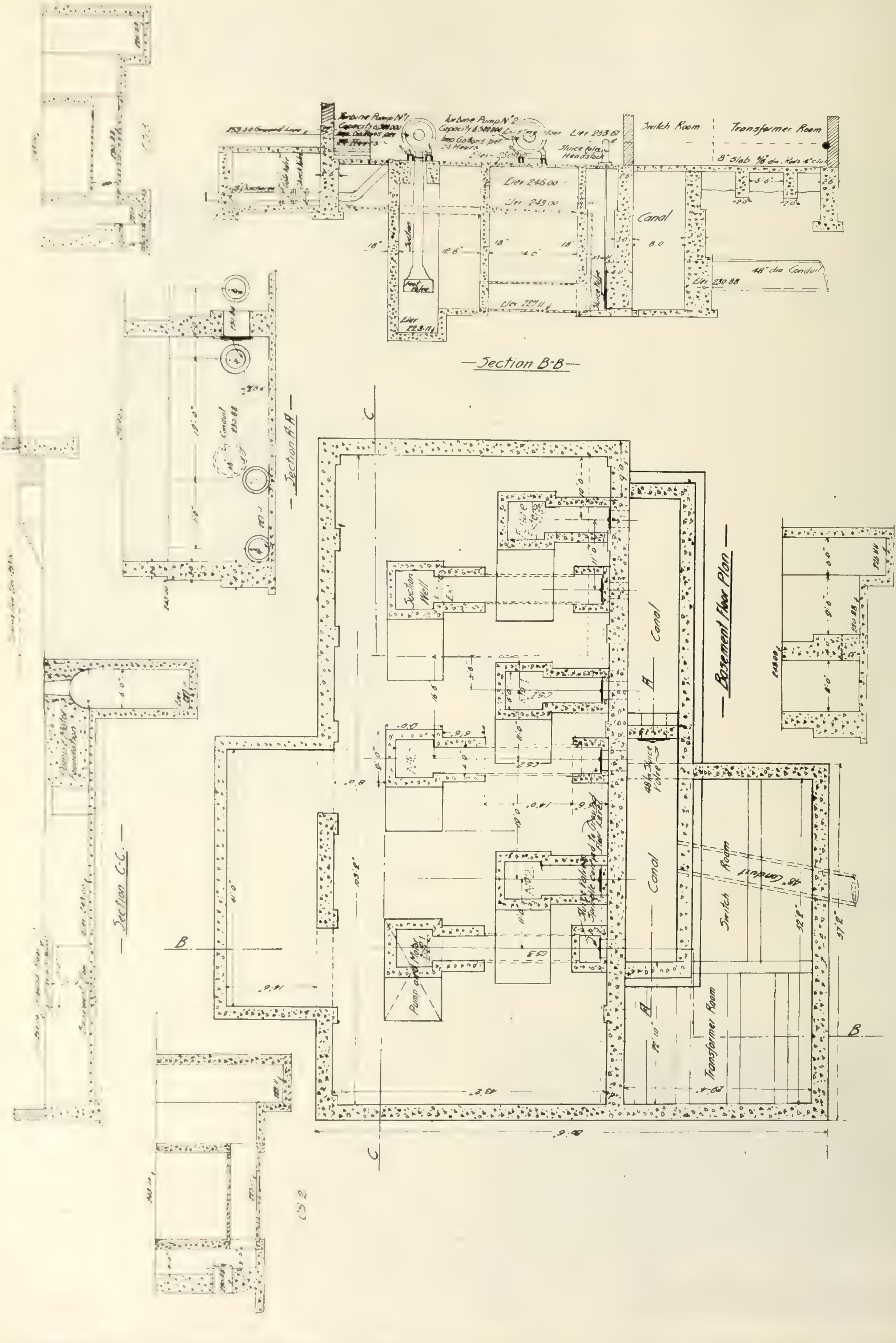
It is not the intention to fully describe the details of the 36-in., 30-in., 24-in. and 18-in. rising mains. Their total length, laid from pumping station to compensating reservoir with sub-mains (given in lineal feet) is:—36-in. diameter, 12,800; 30-in. diameter, 14,796; 24-in. diameter, 5,840; 20-in. diameter, 4,180; 18-in. diameter, 2,653; total 40,178 lineal ft. = 7.61 miles. These mains were laid with a minimum of four feet cover and in some places 14 ft. deep to obviate air pockets. At all high points, double, self-acting, "Klopp" air valves are inserted to allow escape of air during charging of mains and while time mains are under pressure. Connections are made with all intersecting mains over 16-in. in diameter with four-way branches to give generally a better pressure to the existing system.

48-in. header, showing 18-in. and 20-in. intersecting rising mains, Beach Pumping Station, Hamilton, Ont.

The work was carried on by the department on the day labor system and in the case of the 36-in. main, where there were practically no obstructions, a steam shovel was used for excavating and dropping pipes into the ditch. All joints were run hot and caulked with pneumatic tools. In the latter respect it was found that this method of caulking gave a most efficient joint and at a greatly reduced cost over ordinary hand caulking. In the 7.61 miles of pipe laid, on testing and bringing into service, not a single leak was detected attributable to the pipe joints where these had been made with pneumatic tools.

Details of Electrical Pumping Station

The Electrical Pumping Station at the Beach was constructed adjoining the existing station, the intention being to demolish the old and extend the new one over its site. A main feed canal into which the conduits discharge is constructed running the whole length of the building and from which individual feed channels are taken off to each pump suction with controlling valves on each. This will permit of each unit being



General lay-out, Beach Pumping Station, Hamilton, Ont.

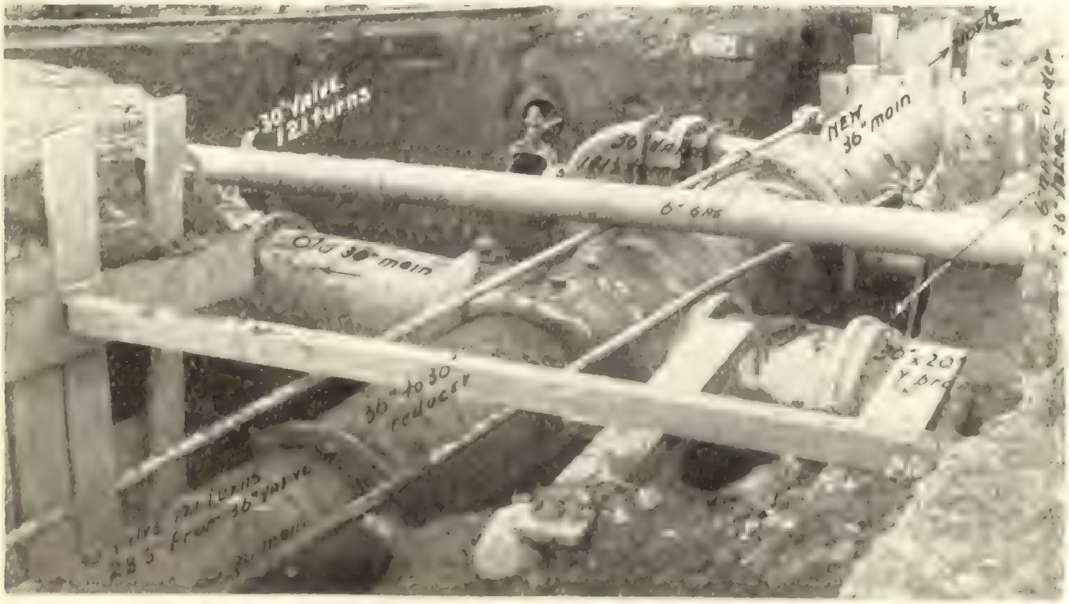
isolated for purposes of repairing foot valves, etc., without interfering with the operation of others. The height of suction lift is kept down in all cases to twelve feet to give greatest efficiency to pumps. The pumping station is equipped with mechanically operated valves on all discharge pipes. The switch room and transformer room adjoining are of fireproof construction. All discharge pipes deliver into a main 48-in. header, with controlling valves on all connections, so that any pump discharge may be directed into any particular rising main in case of repairs to any of the latter. The main header is constructed of 48-in. cast iron flanged pipe and is designed large enough for the extension of an additional 24,000,000 gal. daily capacity.

The pumping station itself will contain at present four electrically-driven units of 6,500,000 Imp. gal. each, with room for extensions on the electrical side to a total capacity of 50,000 Imp. gal. per twenty-four hours. Two of the four 6,500,000-gallon units are 16-in. Worthington two-stage, turbine pumps, direct driven by Canadian Westinghouse synchronous motors. The other two are 16-in. Mather & Platt, special two-stage turbine pumps, direct driven by Canadian Westinghouse Electric synchronous motors. The two first mentioned pumps have been in operation three years and it is the intention to move them into the new pumping station and place them at a lower level to give a suction lift not exceeding twelve feet.

The new electrical pumping station for high level and mountain pumping system now encloses the high level and Mountain pumping systems which up to 1913 had been separate, the latter being a pneumatic lift, direct pressure. This latter was abandoned, however, and the two plants were combined in one building in 1913. The station contains two 7-in. two-stage Mather & Platt turbine pumps, each of a capacity of 1,000,000 Imp. gal. per twenty-four hours for the high level district, and two 10-in. four-stage, Mather & Platt turbine pumps, each of a capacity of 1,000,000 Imp. gal. per twenty-four hours for the Mountain district. The former discharge into the high level reservoir against a head of 131 ft., the latter into the elevated mountain tank against a head of 326 ft. Provision is made for extensions on both systems of an additional 1,000,000 gal. per twenty-four hours for each system. Suction and discharge headers extend under each pump and Venturi meters are placed on each rising main. These act as booster pumps, the water being fed to the pumps at a pressure of approximately forty-five pounds per sq. in. This type of pump gives the advantage of the incoming pressure over the ordinary plunger pump. The rising main from the Mountain pumps to the elevated tank is constructed of high pressure service flanged pipe on concrete pedestals, with concrete thrust blocks to prevent slipping as this is laid at an angle of approximately forty-five degrees from the horizontal.

The whole of this work, with the exception of the completion of the Beach pumping station is now in operation and is giving a reduced friction head at the main pumping station, and a practically unlimited supply of pure water. All designs have been made with the object of giving the highest efficiency in every part of the system, and the existing plants will now be held only as reserve in case of breakdown or repairs to the new plant.

A reservoir with about 120,000 acre-ft. capacity will be built on the Glatzer Niesse, near Ottmachau, Silesia, Germany. It will be the largest reservoir in Germany and its construction is expected to take five years. Of the total capacity, 20,000 acre-ft. will be reserved for flood control; for improving navigation on the river Oder, 70,000 acre-ft. will be provided and it is estimated that in very dry years the river flow can be increased 2,000 sec. ft. The water power can be utilized by fixing the lowest water level in the reservoir. The dam will be about three miles long and it will be the longest in the world. It will consist of an earth embankment with a masonry core. It has been found that one of the strata of the geological formation of the valley is a layer of clay, 25 ft. thick, extending up on both sides of the bluffs, so that the whole reservoir is enveloped by an impervious blanket. The greatest depth of the reservoir will be 40 ft. and its area will be 5,000 acres.



Intersection of 36-in. and 30-in. mains, Barton and Ottawa Streets, Hamilton, Ont. Completed in sixty hours.

Macadam Road Maintenance—with Special Reference to the Use of Oil and Tar

By E. A. James[*]

WHILE a broken stone road is, under favourable conditions, quite serviceable, it is by no means a permanent pavement and, unless efficiently maintained, will promptly deteriorate.

The agencies tending toward the destruction of roads are so many and so various that it requires constant vigilance to guard against and counteract them. Among those which cannot be prevented the chief are: 1, the grinding and crushing action of wheels; 2, impact of horses' feet, loosening and pulverizing the material of the surface; 3, action of rain water in softening and scouring the surface; 4, action of winds in carrying off loosened material.

Other agencies which with proper care may be prevented are: 1, bringing of mud upon the roadway from the shoulders, causing wagon wheels to pick up the surface; 2, insufficient or poorly maintained drainage; 3, action of frost; 4, the use of narrow tires under heavy loads; 5, tracking of vehicles, i.e., running in the same lines. These last two are the direct cause of a great part of ruts seen on some macadam roads to-day.

Yonge Street, Richmond Hill. Oiled with heavy asphalt oil—two treatments.

The ultimate result of the action of these agencies is a gradual decrease in the thickness of the road surface, and where there is any variation in the hardness of the material, the formation of ruts and depressions. According to present practice the principal idea of maintenance with regard to the surface is to keep it smooth rather than maintain it at its original thickness.

The function of maintenance is therefore to counteract as far as possible the effect of those forces of the former class and to guard against, and where possible prevent entirely, those of the latter.

The first essential to efficient maintenance is of course proper construction. Unless a road is well drained and the material well bound the annual cost of maintenance will be greater than the cost of doing the work right in the first place. Assuming then that the road has been well built, i.e., sub-grade drained and well compacted, surface thoroughly consolidated and bound, with a crown sufficient to shed rain water quickly to the sides, shoulders well formed and side ditches opened with a good grade to carry off all surface water, the purpose of maintenance will be to preserve these conditions. The work will include keeping open the side ditches and all outlets to drains and culverts, keeping mud scraped off the surface, removing weeds from the roadsides and the repairing of all ruts and depressions as soon as they occur. When a depression appears on the surface it becomes a basin to hold water which in turn softens the road and hastens disintegration. Therefore the surface must above all be kept smooth and well crowned.

Since the damage done by frost is always a result of poor drainage it follows that if due regard is paid to drainage at the time of construction and if the efficiency of the drainage facilities be maintained there need be no fear of frost.

The best system of maintenance appears to be the Patrol System. Under this system a man is given a section of road and held responsible for its upkeep. The length of road which one man can properly look after varies with the quality of the material and nature and extent of the traffic. Ordinarily one man can keep from four to six miles in good repair.

The best time for examining the entire length of a section is immediately after a rain. This will show up all ruts and other depressions and also any obstructions or lack of grade in side ditches and culverts.

The best method of filling ruts and low spots in the surface is to pick the stone loose in and for several inches around the depression, add a little fresh stone and grit, wet it, and tamp thoroughly. It may be found that traffic will disarrange the stone somewhat, but if it is gone over a few times at intervals of a day or so it will be found to have set and become an integral part of the road, and, if the work has been carefully done, indistinguishable from the remainder of the road. This work all resolves itself into an attempt to maintain the original contour of the road and to keep the surface drainage perfect.

Another cause of trouble in macadam roads is allowing the earth sides to become cut up and higher than the edge of the stone, thus impounding water that would otherwise run off. These earth shoulders should be kept trimmed below the level of the stone. In this connection an occasional trip over the road with a split-log or plank drag will be found beneficial. By this means the earth shoulders may be kept in such condition that they will often be found preferable for driving in dry weather to the stone section.

The remaining most important part of the maintenance-man's work is the keeping of all ditches, drain and culvert outlets open. This work will be heaviest in the spring and fall, when ditches tend to become clogged with leaves and other debris. During the winter special pains must be taken to keep all these water-courses in first-class working order, bearing in mind that the principal idea in winter is to have a course ready for the water as soon as the snow starts to melt. In this as in other work it is easier and cheaper to anticipate trouble than to remedy it after it occurs.

A discussion of the methods of maintenance naturally includes methods by which wear on road surfaces may be reduced, thus lessening the cost of mainten-

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Applying "Tarvia A" by auto truck, Eaton Road, York County, Ont.

ance. At the present time the two worst enemies a macadam surface has are the automobile and the narrow tired wagon, the former being particularly detrimental in dry weather and the latter when the surface is wet and inclined to be soft. The narrow tires act as a knife and cut the road. The problem of the automobile is different however. The pneumatic rubber tire has come to stay. The annual increase in the number of automobiles in use during the past few years being sufficient proof of this. The rubber tire of the automobile being absolutely necessary to the comfort of motorists it follows that the road must be made to suit the tire and not the tire regulated to suit the road.

It has been clearly demonstrated that the bond in ordinary macadam roads is insufficient to protect it against the somewhat complex action of the tire of the automobile travelling at high speed. The dust raised by this class of vehicle is blown entirely off the road and a fresh supply raised; this repeated action

Eaton Road, Islington, Ont. About six miles treated with "Tarvia A" in 1913 resulting in the wearing down of the road surface, in some cases amounting to inches in one season.

The easiest method of preventing wear is by keeping down the dust. This may be accomplished by periodically sprinkling the road, but this method is expensive and unreliable. In hot weather one end of a section will be dry before the sprinkler has reached the other end and the relief will be only partial. Some other means of laying the dust must be adopted. The most satisfactory method is in the use of some of the various road oils.

While oiling a road is not considered a permanent remedy for the disintegration, it serves to keep down the dust, thus preventing successive quantities being raised, and by this means temporarily preserves the road. There are many varieties of oil on the market for this purpose, some of which are little better than water, while others, having a bituminous base, on the evaporation of the volatile constituents, leave a certain amount of bitumen to act as an aid to the binder in the road. This bituminous residue is increased at each successive application which may be made fewer and lighter.

The cost per annum of applying oil at current prices amounts to from eight to fifteen per cent. of the original cost of the road if built by day labor, or from five to ten per cent. if built by contract. This expenditure is justified in the elimination of the dust nuisance and the decreased cost of maintenance as well as in the increased life of the road.

Cost, per application, of oiling one mile of road, of different widths with varying quantities of material.

Oil, 7½ cents per gallon.

Cost of application, $25.00 per mile.

Width of road	Square yards per mile	¼ gallon per square yard	½ gallon per square yard	¾ gallon per square yard	1 gallon per square yard	1¼ gallons per square yard
10	5,867	$135	$245	$355	$465	$ 575
12	7,040	157	289	421	553	685
14	8,213	179	333	487	641	795
16	9,387	201	377	554	729	905
18	10,560	223	421	619	817	1,015
20	11,733	235	465	685	905	1,125

Oil, 8½ cents per gallon.

Cost of application, $25.00 per mile.

Width of road	Square yards per mile	¼ gallon per square yard	½ gallon per square yard	¾ gallon per square yard	1 gallon per square yard	1¼ gallons per square yard
10	5,867	$150	$275	$400	$525	$ 650
12	7,040	175	325	475	625	775
14	8,213	200	375	550	725	900
16	9,387	225	425	625	825	1,025
18	10,560	250	475	700	925	1,150
20	11,733	275	525	775	1,025	1,275

Ordinarily the following applications will suffice:—

First Year—First application, ½ gallon per square yard.
Second application, ¼ gallon per square yd.
Subsequent Years—Two applications, each ¼ gal. per sq. yd.

Brick Pavements—Their Maintenance and Repairs

By F. F. Townsend, C.E.*

In travelling over the country inspecting various departments, it is strongly impressed upon one's mind that those in charge of the maintenance and repair of brick streets do not realize their importance or understand the necessary procedure to obtain satisfactory results. It is a well established fact that misuse of pavements does more to ruin them than the traffic ever does, and, as an engineering acquaintance of mine has said, "Brick pavements do not wear out, they are destroyed."

I asked a gentleman of high standing in the brick paving line the following question: "What are the principles of maintenance and repair on a properly constructed brick pavement?" His answer was: "There are none." This was altogether too optimistic for the purposes of this paper, so I found it necessary to drop the word "properly," developing the theory that repairs to brick streets are largely due to mistakes occurring either before construction or during the same, and not to any particular weakness in the materials themselves.

The critical period in the maintenance of the brick pavement is the first two years of its life. There are always a few bricks, even under the best culling, which are left in by oversight. As soon as these bricks commence to shatter or wear unevenly they should be replaced. There are some joints that may not have been properly filled. These should be watched for and refilled if possible. Some cracks may occur, due to frost or uneven settlement, and where these open up sufficiently they should be grouted to protect the edges of the crack. These are the principle items of maintenance on city streets. On country roads a further important item is the cleaning of the ditches. On large amounts of brick country roads around Cleveland, Ohio, and Buffalo, New York, attendance to drainage is practically the only item of maintenance that has been recorded.

Under the item of repairs we will consider all operations which require the removing of sections of pavement, and it will be well to state briefly some of the causes which lead to the necessity for them.

As stated previously, there are some mistakes which occur before construction. These are, generally speaking, mistakes of administrative and legislative officers and can be avoided by the engineer only through advice. I refer to the leaving of underground work upon the street which is handled by city departments or public service corporations until about one week before construction starts. Then the sewer department decides that connections must be made to every lot, likewise the water company has to lower its pipes in order to get below the foundation of the pavement, or the telephone company must get its wires underground. It is a fatal error to leave this work until just before construction, because, as it is generally done in a hurry to get out of the way of the contractors, it has no time to become properly compacted and is very likely to cause settlement and eventually repairs will be necessary.

I was in a city recently where one week after the pavement was grouted the street car company came on and broke holes in the pavement about one foot square at every rail joint, having omitted to bond their rails before construction.

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*Assistant Engineer, Inspection Department, Dunn Wire-Cut-Lug Block Company.

These matters should certainly be governed by ordinances prepared by the city authorities and enforced by them. In many cases the water or sewer connections are left until after construction and we hear everywhere the complaint that no sooner is a pavement laid than we begin to tear it up.

Mistakes in Construction

Then there are mistakes during construction which will make repairs necessary. Some of these are as follows:

(1) Neglect to have the sub-grade properly prepared.

(2) Poor foundation laid upon the above.

(3) Failure to compact properly the sand cushion or have it of uniform depth.

(4) Improper filler or the poor application of the same.

All of these tend to one and the same result—the breaking up of the bond upon the street and the consequent displacement or shattering of the brick themselves.

Poor preparation of the sub-grade and insufficient care in replacing soil over underground work may sometimes be made up for by having an extra good concrete foundation; that is, one which will bridge over the bad places and overcome in this manner the settlement.

If, however, the foundation fails, there is only one way to repair the damage, and the general method will be the same for spots due to poor sub-grade and those due to improper covering of underground work. The bad spot must first be entirely removed down as far as the soft material extends. It is useless to take up the brick and just put in a little sand to bring the spot up to grade, relay the brick and leave it. This method will, in all probability, result in having to do the same thing over the next year and, although in time, after settlement has ceased, we may get a fairly good result, it will be more expensive, and it is better to remove, at once, the cause of the trouble. The next step is to get the cavity thus formed filled with the same material in more compact shape or with some other more suitable material. If the natural sub-soil is sand or gravel, the problem is comparatively easy and in fact it is very uncommon in such soils to have any trouble from this source. If, however, our sub-soil is of loamy nature or of clay, the problem is of a far different nature and must be handled with extreme care. I have known trenches filled with this material, when improperly back-filled, to keep on settling for a year or more after construction. Only last week I was over a pavement upon which the sewer could be traced for nearly the full length of the street. This sewer was constructed two years before the pavement, according to the records of the city engineer's office.

Back Filling Trenches is an Operation of Great Effect Upon the Pavement Laid Over Them

The method most commonly used for back-filling is that known as puddling, consisting of running water into the trench, throwing in the material and allowing it to settle into place. This works very well in many cases, especially where we have deep trench work so that the upper tamped material compacts the filling below. This may not, however, be the case in shallow trench work, say from four to six feet. While talking with the repair man of the city of St. Louis recently, he stated it as his belief that the trouble with puddled trenches was due to the top four feet not becoming properly compacted. He stated that trenches four feet deep, put in by puddling, settled about the same amount as trenches sixteen or seventeen feet deep put in by the same method. He prefers gradually to reduce the water up to the four-foot point and tamp the remaining material firmly into place. Every engineer must study the soil with which he has to deal and determine the best methods for his particular locality. In shallow trench work many engineers favor tamping or refilling with gravel and discarding the old material, while in very shallow patch work it is often a good plan to fill the whole space with the foundation course. There are some mechanical tampers now on the market which we believe should give very good results on this class of work. It is needless to say that no back-filling should ever be done with frozen ground, as this will always have large settlement, whatever the material.

The Foundation Course

Poor foundation course is the second trouble mentioned above. It may be caused by leaving the cement out of a batch of concrete or similar mistakes. The affected spot must be removed and put back with care. If it is other material than concrete it must be thoroughly tamped into place, making it even with the remaining base. If concrete is used, the old concrete must be roughened and all loose material and dirt cleaned off so as to get a good bond. It is a good idea to slope the sides of the old concrete base in such a manner as to give the new concrete a bearing on the old, while in some places engineers require reinforcement to be placed in the bottom. After placing this base it must be allowed to set for at least four days before placing the pavement upon it.

A poorly compacted sand cushion or one of excessive depth is the third cause of trouble mentioned above. Upon the properly laid base this should be placed with a uniform depth and thoroughly compacted. It should be so placed that when the brick are laid and tamped they will be even with the old surface. The crowning of patches should never be tolerated. It is simply an admission of the poor quality of the previous work and it never gives satisfactory results. This is especially the case where cement grout filler is used, for the grout will not allow the bricks to settle without breaking the bond and this is the very thing which we desire to correct. If the crowning does not settle there will, of course, be a hump in the pavement, which will be unsightly and an annoyance to traffic.

Filling of Joints

The last item mentioned above, the improper filling of the joints, is one of the most common troubles making repairs necessary. Where sand filler is used, it is an easy matter to re-lay the blocks and sweep in the sand. This is also the case with asphaltic and tar fillers and the advantages of these are that traffic can be immediately permitted. They, however, will require much more repairing, so that the ease in putting them in is counterbalanced by the extra amount. They should never be used to repair grout-filled streets, as they will not harmonize with the rest of the pavement and the blocks put in with them will soon round and become unsightly.

There are two general ways in which grout-filled streets fail. The bond may break up in patches due to poor spots in the foundation or to [illegible] poor batch of grout, or they may fail for entire [illegible] due to some fatal error in the method of application. There may be several things the matter with grout, such as poor cement, poor sand or poor mixing, but it is the opinion of the writer that much poor grouting is caused by not regulating properly the amount of water used in each batch. If too little water is used, the grout will not penetrate the joints and we have bridging which will soon break up. This is particularly so where the lugs on the blocks are not properly formed or are too small to give proper spacing. If too much water is used, the grout will be so thin that we will have separation, giving the same result as if it had been unmixed.

The writer was on work last season where there was complete separation, due to excessive water, the sand having settled to the bottom and the cement run away with the excess water. Where either of the above conditions occur generally over the pavement, the whole will break up. Dumping the grout greatly aggravates this trouble, if it is done in large amounts; that is, a grout that if put on with scoops might cause no trouble, when dumped on in large amounts will cause separation or bridging.

Relaying

Where the bond has broken on a pavement there is only one way to correct it; that is to take up the bricks and relay them. Regrouting will do no good, as it will not go in far enough and the bond will soon break up again under traffic. If the pavement is broken up in small patches it is feasible to do this. If, however, the trouble is general, we must ordinarily leave it alone and be satisfied with a filler about as good as sand.

In making a patch the same care must be taken as in the original pavement construction. The brick must be laid smooth and even with the remainder of the pavement, properly tamped in and properly grouted. The traffic must be kept off for a period of from seven to ten days, according to the weather conditions. If these precautions are taken, when finished the patch should look equally well as the other paving. In doing this patching it is the custom in some places to dovetail the work in with the rest of the pavement. In other places they just cut out a square patch and lay the new brick independently of the others. The first method is preferable if it can be done without disturbing the bond on the other pavement, but this is often very hard to do. It is next to impossible unless the blocks used in repairing are of the same size as the original ones. City engineers have at times had trouble in finding blocks to make repairs, it being the custom for different firms to make blocks of different size. When repair time came the company having made the original blocks was out of business and no brick could be found which would fit. There is a commendable tendency at present among manufacturers to standardize sizes so that the different makes will be interchangeable. This is evidenced by the fact that the sixteen firms which make the Dunn wire-cut-lug block have agreed to make a size which will lay just forty to the square yard and be interchangeable. This we believe will overcome the former difficulty.

Uniform joints of proper width are also very desirable on paving blocks, and this is attained in a high degree on the wire-cut-lug blocks. The lugs being cut on cannot be malformed.

In regard to the cost of maintenance and repair, little can be said, because records are very scarce. The Bureau of Municipal Research, of Cincinnati, Ohio, found the cost of maintenance and repair to be 1.2 cents per square yard per year. The city of Baltimore found the cost to be ½ cent per square yard The representatives of both cities stated that the figure was hardly fair, as it took in some very poorly constructed streets. Some of the streets properly put in had shown no maintenance and repair charge for a long term of years.

Low Level Bridges at Edmonton, Alta.

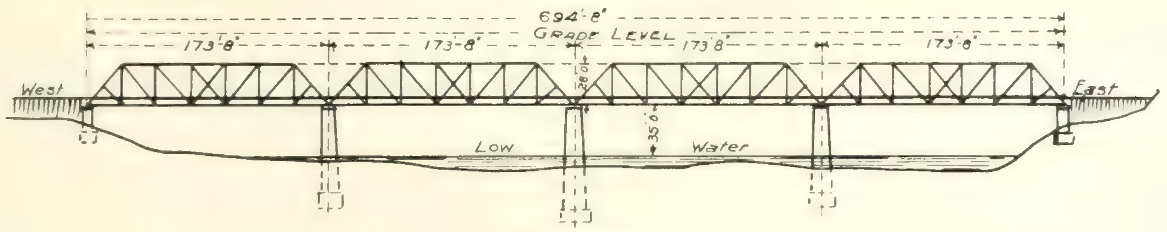
By H. F. Christie, Assistant City Engineer, Edmonton.

OWING to its rapid growth and consequent increase in traffic across the river the city of Edmonton, situated on the north branch of the Saskatchewan River which separates the northern and southern portions of the city, required additional accommodation for the trans-river traffic which was carried solely by the McDougall bridge, erected in 1900 by the Dominion Government. At present there are three low level bridges within the city, viz., McDougall, east end, completed in 1912, and Fifth Street, completed in 1914.

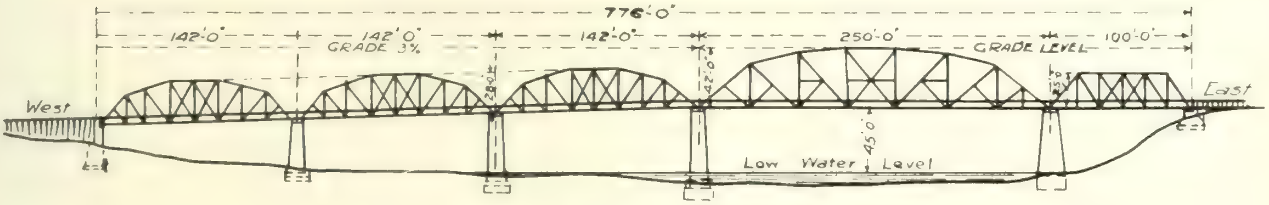
McDougall bridge accommodates steam, street railway, vehicular and pedestrian traffic, on a roadway of seventeen feet and two outside sidewalks 4 ft. 4 in. wide. When steam traffic occupies the bridge all other traffic is suspended. The structure is composed of four equal spans of 173 ft. 8 in., making a total length of 694 ft. 8 in. The trusses are the rivet connected Pratt type, 170 ft. 11 in. centres of bearing pins and 28-feet-deep centres of chords. The substructure consists of concrete piers with foundation on hard shale and abutments on timber pile foundation. The clearance height from low water level to superstructure is thirty-five feet.

As to the location of the east end bridge three sites were proposed and investigated. The first suggested was at River Street, but this was considered too near the existing bridge and was therefore rejected. The second site was at the bend of the river in line with the Clover Bar Road. This also was rejected on account of the unstable bank on the east side of the river. The third proposed, and present site, was decided upon as the most desirable location, especially having regard to the district served and the grade of the roadways approaching the bridge. The roadway on the east side of the valley has a maximum grade of eight per cent., that on the west side having a maximum grade of six per cent.

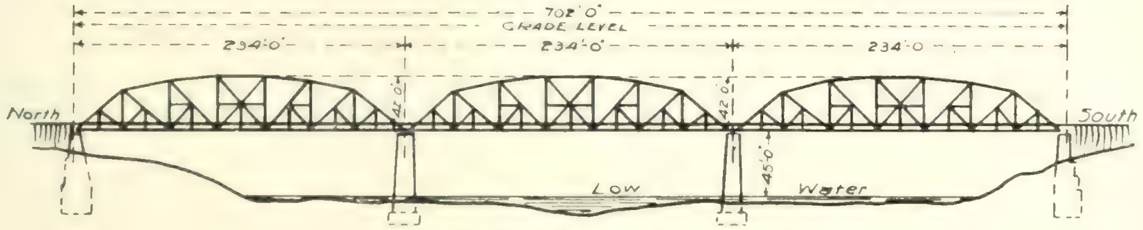
The Dominion Government regulations demand a clearance over the channel of forty-five feet from low water level. Owing to the difference in the level of the channel span and the roadway at the west end of the bridge, it was necessary to place the three approach spans on a grade of three per cent. This bridge accommodates street railway, vehicular and pedestrian traffic on a roadway twenty-four feet wide and two outside sidewalks six feet wide. The three grade approach spans are each 142 feet long, channel span 250 feet, and west approach span 100 feet, making for the structure a total length of 776 feet. There are three types of trusses, all rivet connected, in the bridge. The grade approach spans are Pratt trusses with curved top chord, the channel span Petit truss, and the west approach span Pratt truss. It may be claimed in regard to the last mentioned truss that for appearance it should have a curved top chord, but from an engineering point of view, having regard to the channel



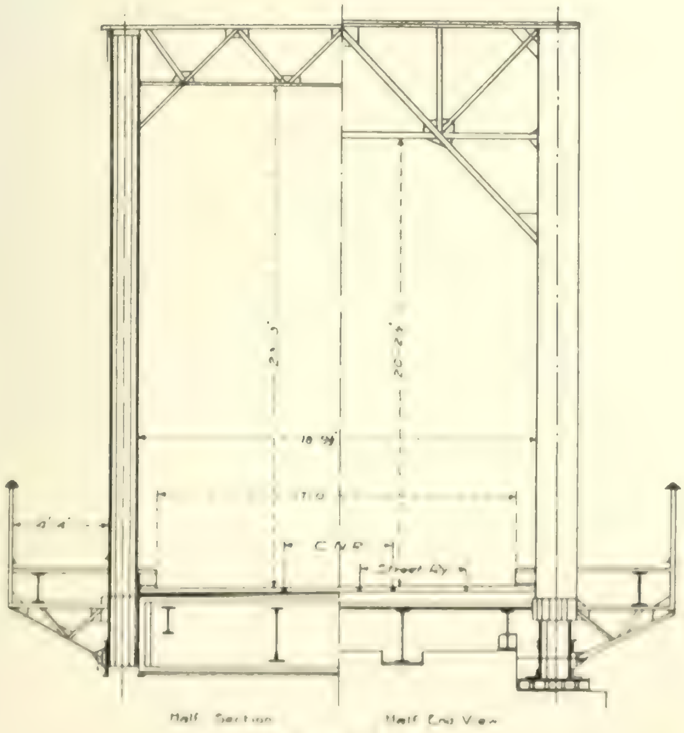
MacDougall Bridge.



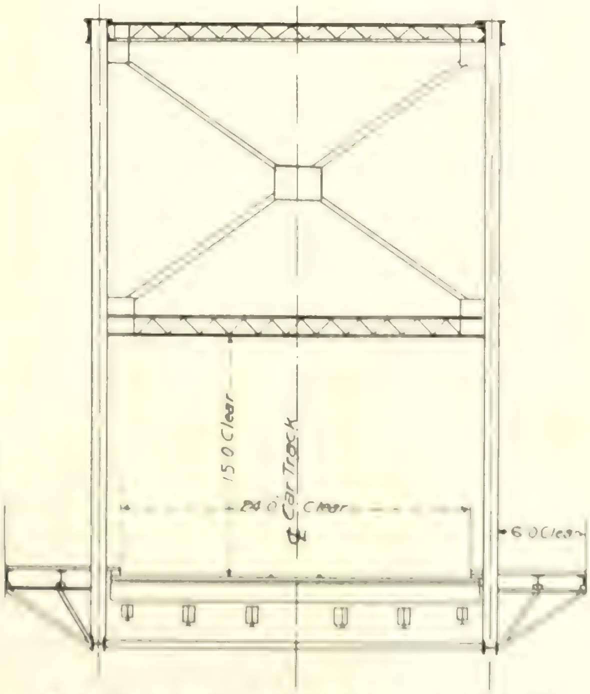
East End Bridge.



Fifth Street Bridge



MacDougall Bridge



Typical Cross Section, Fifth Street and East End Bridges

Low Level Bridges at Edmonton

of the river, length of span and loading, it would be incorrect to curve the top chord.

The substructure consists of concrete piers and abutments with foundation on hard shale except the east abutment which rests on hard clay. When the cities of Edmonton and Strathcona amalgamated, it was agreed that a bridge should be constructed across the river, in the vicinity of Fourth Street, Edmonton, thus deciding the location of Fifth Street bridge. This structure is similar, in respect to traffic accommodation, to the east end bridge, the cross sections of the two bridges being practically alike. The roadway approaching the bridge on the south side of the valley has a maximum grade of five per cent., and on the north side a maximum grade of twelve per cent. The trusses are rivet connected Petit type, each 230 ft. 5 in. centres of bearing pins, and have a maximum depth of 42-feet centres of chords. The total length of the structure is 702 feet.

The foundations of the concrete substructure is hard shale. The foundations for the abutments having been carried down on account of layers of soapstone, the presence of which was disclosed by the test borings.

The floors of both the east end and Fifth Street bridges are similar. Timber ties of 10 x 10 in. fir, about 2 ft. 6 in. centres, are laid transversely on the steel stringers, then 4-in. longitudinal planking is laid on top of the ties, and the wearing surface of 2 in. x 4 in. tamarac, laid on edge at an angle of forty-five degrees to the centre line of the bridge, rests on the planking.

The Design and Value of Sedimentation Basins for Water Purification and Softening Plants Operated on the Continuous Principle

By Alexander Potter, C.E., Consulting Engineer, New York City.

SEDIMENTATION, either alone or in conjunction with other processes, is used in nearly all water purification plants. Irrespective of whether the settling process is carried on with or without the aid of chemical precipitants and coagulants, sedimentation basins can be operated either by the fill-and-draw method, a strictly intermittent process, or more or less continuously. The fill-and-draw method of operating such basins is not now generally used, as the continuous process gives quite as good results as the intermittent one and possesses an economic advantage of delivering the settled water at practically the level at which the raw water is admitted to the basin.

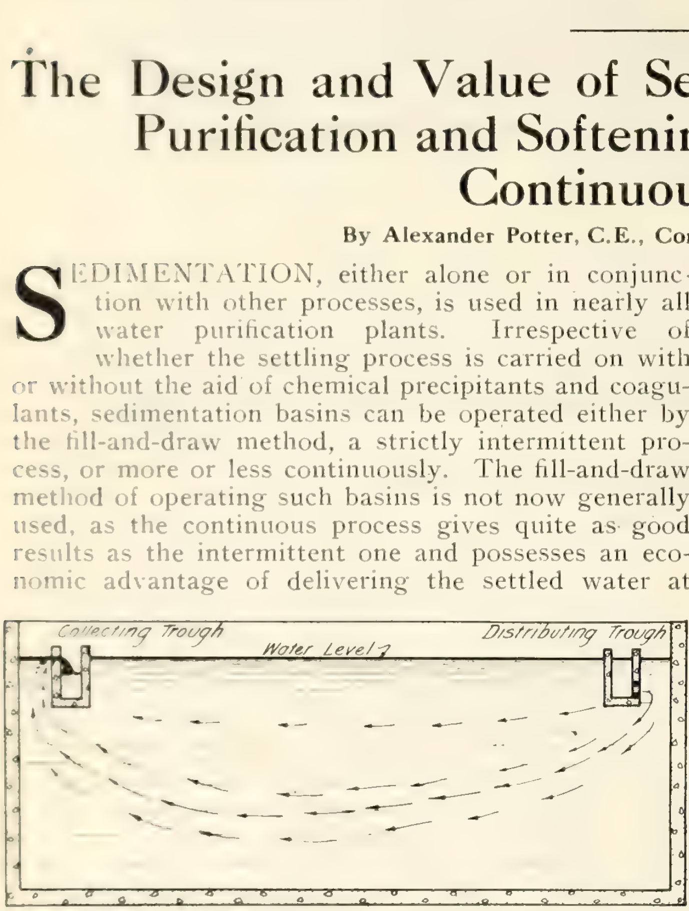


Fig. 1—Settling basin operated continuously.

QUIESCENCE IS ESSENTIAL

In a sedimentation basin operated more or less continuously the unsettled liquid enters the basin at one end and the settled water is drawn off at practically the same rate at the opposite end of the basin. When there are a number of such basins they can be operated either in parallel or in series, depending upon local conditions and the character of the water. Better results are obtained by basins operated in series than those operated in parallel.

Disturbances created in settling basins tending to lower the settling efficiency are due to several causes, namely: vortex motion, set up by the kinetic energy of the inflowing liquid, disturbances which are apt to continue for a long time when once set up; and the currents set up by the action of the wind, or by the temperature changes which take place in the liquid in the settling basin.

There is no reason why when a settling basin is operated continuously, the process should be materially interfered with by vortex action caused by the inflowing liquid, as long as the currents and eddies due to the inflowing water are prevented from reaching the main body of the settling chamber proper. Just as good results can be obtained in a basin operated continuously as in one operated on the fill-and-draw method and at much less cost. The method, illustrated in Fig. 1, of having the liquid enter the basin in a direction opposite to that it must take in traversing the basin, appears to be a very simple and effective way of arresting vortex motion by impinging the current against the wall of the basin.

Other methods have been used more or less successfully. One is to introduce the raw water at one end of the basin in a downward direction through one or several inlets. Such inlets are known as downtakes and should, to be effective, be carried down about two-thirds of the depth of the basin. When the water is introduced into the basin in the same direction that it must take in passing through it, vertical baffles placed a short distance in front of such inlets can be used to arrest the currents and eddies caused by the inflowing liquid and prevent them from disturbing the quiescence of the settling compartment.

SLUDGE PROBLEM

The organic and inorganic matter removed from the water by sedimentation collects in the bottom of the basin in the form of a semi-liquid sludge. This sludge on standing gradually compacts, the consistency attained depending upon its composition. Frequently it is such that the sludge stands at a very steep slope for a considerable time. This deposited sludge often reaches, in a very short time when turbid waters are treated, such volume that unless frequently removed the space occupied by it reduces very materially the capacity of the settling tank and consequently reduces the efficiency of the settling process.

With reference to sludge removal, settling tanks can be further classified into intermittent sludge removal and continuous sludge removal.

INTERMITTENT SLUDGE REMOVAL

Solids deposited in sedimentation basins divide themselves into two general classes. Those of heavier specific gravity settle in the zone near the inlet but do not settle at a uniform depth over this zone. The balance of the sediment, because of its lighter specific gravity and the currents caused by changes of temperature and the velocity in the water, settles more or less uniformly over the rest of the basin. A baffle wall constructed across a settling basin, located one-fourth or one-third distant from the inlet, is very efficient as it prevents the currents in the basin from disturbing and carrying forward the mass of sediment deposited in the first zone of the settling basin.

To facilitate the removal of the sludge, the bottoms of such basins are given frequently considerable slope toward the underdrain openings, so that the sludge can be more readily flushed out through these. Unless there are a large number of settling units, the placing of one of the basins out of service for the purpose of cleaning interferes with the operation of the plant. Furthermore, the necessity for cleaning frequently arises at a time when the character of the raw water is such that sedimentation is most needed and when none of the basins can be spared for cleaning although the accumulated sludge deposits are materially reducing the capacity of the basins. The economy of being able to clean such a basin without having first to empty it is obvious, and with that end in view several methods have been devised.

CONTINUOUS SLUDGE REMOVAL

Two principal types of tanks have been devised in which the sludge can be removed without materially interfering with the continuity of the sedimentation process.

Tanks with Hopper-shaped Bottoms

Such tanks are quite successful and have been used to some extent in water purification plants, but more generally in sewage disposal plants. The principal objection to the more general introduction of the use of such tanks in water purification plants is their high cost of construction. In sewage disposal plants, on the other hand, where the sludge problem is the most important one, because of the great quantity of sludge to be handled, this objection does not hold to the same degree.

Tanks With Perforated Bottoms

A number of sedimentation basins have been built with horizontal perforated bottoms so that the sludge can be drawn off at regular intervals and without materially interfering with the sedimentation process. The writer has built a number of such tanks. The first was built in 1907 in connection with the McKeesport, Pa., water softening and purification plant, which plant has continued in satisfactory service ever since. In this type of tank the sludge removal is accomplished by having the bottom of the settling compartment perforated with circular openings varying in diameter from [illegible] in. to [illegible] in. and spaced not more than 3 feet centers in all directions. These holes discharge into an underdrain system consisting of vitrified piping connected to a common channel. Quick-opening valves located in a pit are used to regulate the sludge discharge. Should the underdraining of the entire basin prove too expensive, the underdraining of the first section of the tank will increase the interval between cleanings fully ten times over that required in a plain sedimentation basin because the greatest percentage of deposits collect in this section of the sedimentation tank. This plan was adopted at Muskogee, Okla.

Figs. II. and III. show the general arrangement of the underdrain system used in the settling tanks at Muskogee. Fig. II. is a section and plan of a portion of the tank showing the arrangement of the underdrain system. Fig. III. shows the arrangement of the sludge valves.

PRINCIPLES OF DESIGN

In designing an underdrained settling basin of the type described a number of precautions must be taken.

Zone System

The underdrain system must be laid out in a series of zones, so arranged that the sediment will be deposited uniformly over the area of any one zone. This is very important for whenever the suspended matter is not deposited uniformly over the area of any one zone, clear water will be drawn in at these openings where the depth of sediment is least, at the time, when sediment may still cover other openings to a considerable depth. Such a condition not only tends to a great waste of water, but is apt to result in the ultimate clogging of perforations, as the operator closes the sludge valve shortly after the discharge shows comparatively clear, not knowing that a considerable area is still covered with sediment.

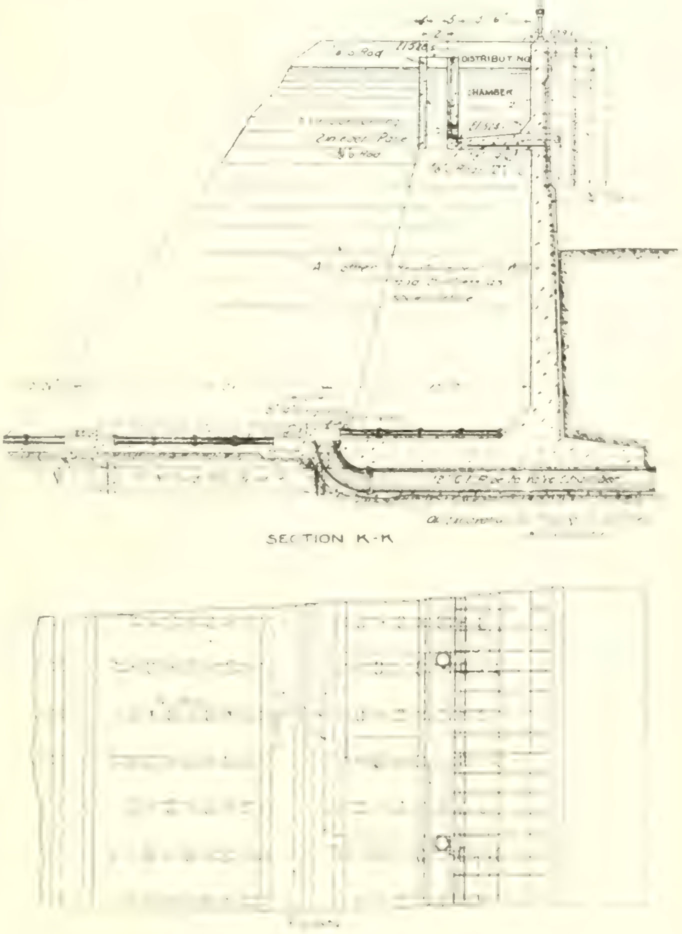


Fig. 2.—Section and plan of portion of tank.

Perforations and Underdrains

The underdrains and perforations must be designed so as to give the same degree of suction over all the

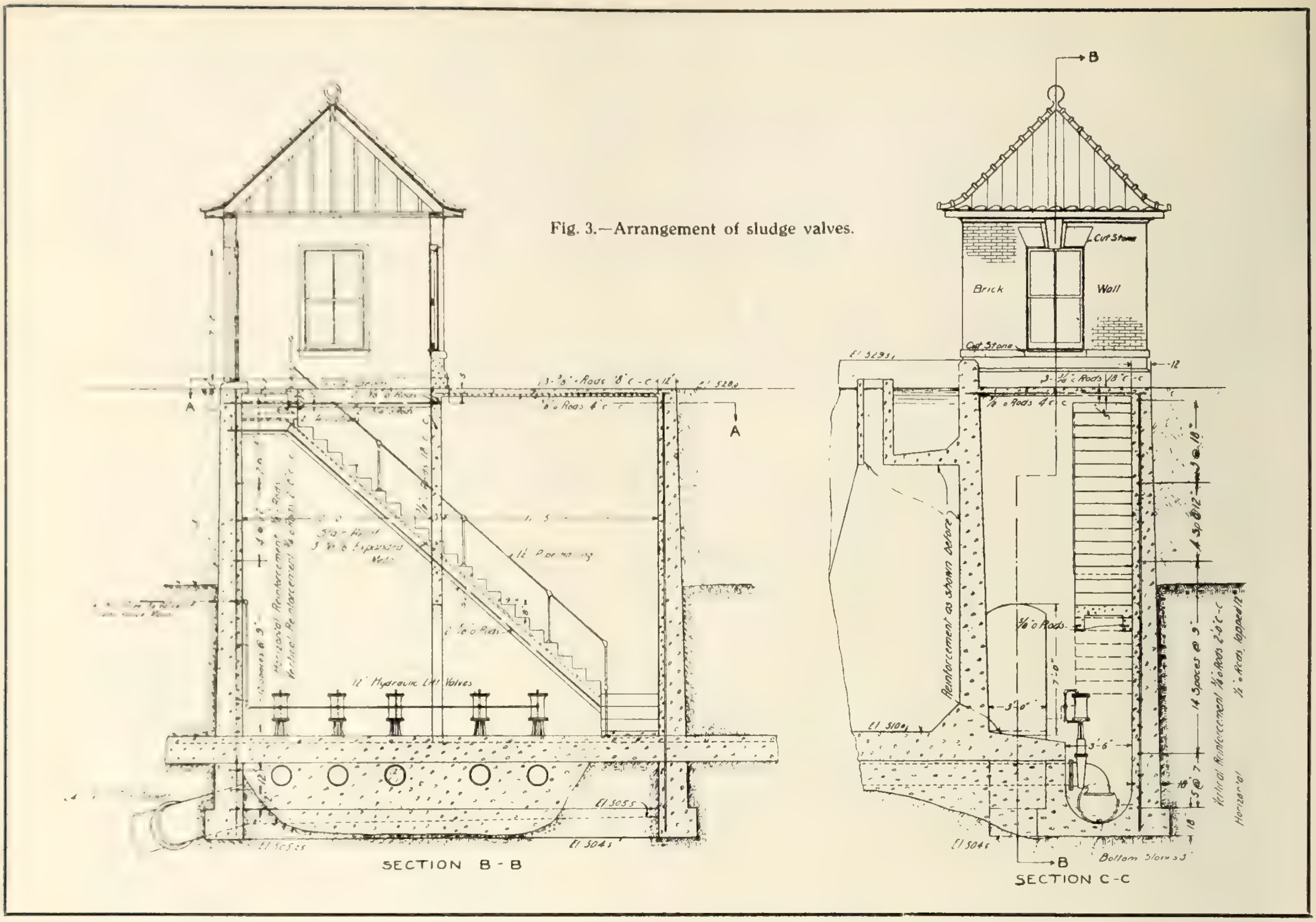


Fig. 3.—Arrangement of sludge valves.

holes in any one zone, otherwise clear water will be drawn in at those openings where the suction is greatest, while sediment may still cover to a considerable depth those perforations where the suction is less.

The total head available for operating such a system of underdrains is the difference in elevation between the water in the basin and the sludge outlet. A head of 10 ft. is ample for operating such a system; with the smaller head every precaution must be taken to reduce to a minimum loss of head at entrance, the frictional loss in the underdrain system and the velocity head at the sludge outlet, so as to be able to utilize as much of the head as possible for creating a scouring velocity through the orifice.

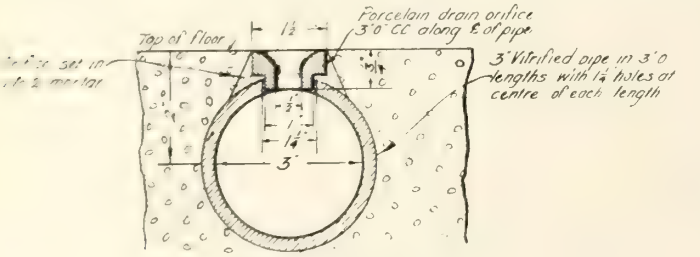

Top of Floor
1½
Porcelain drain orifice 3'0" CC along ℄ of pipe
3" Vitrified pipe in 3'0 lengths with 1¼ holes at centre of each length
1¼
1
3"

Fig. 4.—Detail of underdrain and orifice.

Fig. IV. is a detail of the underdrain and orifice to be used by the writer at Moorestown, N.J. In this case the underdrains consist of 3-in. vitrified pipe made in sections 3 ft. long in which are cast 1¼-in. circular openings. In these openings are placed porcelain orifices, of the special design shown in Fig. IV., so as to reduce the loss of head at entrance to a minimum.

The underdrain system should be designed so as to keep the velocity at about 4 ft. per second, or less. If the maximum velocity in the underdrains is too high it is impossible to obtain a uniform suction for all the openings in any one zone. The relation of valve area to the openings in any one zone controlled by the valve depends to some extent on the depth of the water in the settling basin. The greater this depth the smaller can be the valve area in proportion to the orifice openings.

When such a system of underdrains is properly designed, there is little likelihood of the underdrains becoming clogged with sediment. The McKeesport plant is now in operation over five years and no difficulty whatever is experienced in keeping the underdrains open and flushing out the sludge.

Bulkheads for tunnel forms are always difficult to build because of the roughness of the rock profile. The Pneumatic Concrete Placing Company, of New York City, which is specializing in tunnel-lining work, has been experimenting to find a suitable way of building such bulkheads quickly and cheaply and has found that cement sacks three-quarters full of sand can be used successfully. The sacks are laid on top of each other in the same way as bricks in a wall and can be fitted into all crevices of the rock, following closely the irregularities of the profile. It is stated that one unskilled laborer placing sacks replaces two carpenters building forms. A bulkhead formed in this way is said to be tight and is left in place the same length of time as a wooden one. When the sacks are removed the concrete surface is rough and gives a good bond with the adjacent section.

Depreciation in Relation to Municipal Works

By R. O. Wynne-Roberts, Consulting Engineer, Regina

IT is noticeable that on the North American continent much attention is now being paid to the question of depreciation of public utilities. One reason for this is the creation of Commissions by almost all the States and the discussion of municipal and other loans in Canada.

A perusal of the voluminous annual reports of the American Public Service Commissions will at once show that depreciation of utilities is being fully considered when rates are revised, whilst in Canada it is sometimes taken into consideration when the subject of the financing of such undertakings is discussed.

Not only are the American Commissions and Canadian authorities paying closer attention to the financing of public undertakings, but there are several public organizations constituted for the purpose of investigating the methods in vogue in Europe and elsewhere, with the view, among other things, of the adoption of the best way to provide for depreciation; and those in control of public utilities are faced with serious problems of rectifying any deficiencies which have arisen owing to the absence of adequate provision for depreciation in the past.

For instance, the National Civic Federation of New York in 1906 sent fourteen gentlemen—each of whom occupied a high position in his own profession—to study municipal and private ownership of Public Utilities in Great Britain. The proceedings of the National Municipal League of America also afford some indications of the trend of public opinion in this matter.

The movement towards municipal ownership is growing. It is advocated strongly by some American organizations, owing to the difficulties which have occurred in many cities due to the granting of franchises for various utilities. The policy of municipal trading has been adopted by many Canadian cities. So long as politics are excluded and capable men are appointed to manage these concerns, there is reason to expect that revenue-producing undertakings can be conducted by municipal departments to the advantage of the ratepayers.

Municipal ownership, however, entails great responsibilies, not only to the ratepayers and the patrons, but also to the investors. "Efficiency and economy" is a useful slogan for special occasions, but to practise it every day is quite a different matter. Efficiency means maintaining a department at a top-notch condition and the service at the same time rendered at a reasonable cost, whilst economy is often interpreted as a reduction of expenses to an excessive degree. This attitude on the part of city administrators is as common in the Old Country as in the new.

Physical depreciation is influenced by these factors in a tangible measure, for if any plant is not maintained efficiently, then its value quickly falls and this in turn affects the investors interests and may also in time raise the price of the commodity produced or the service rendered.

One of the problems which confront the municipal engineer and the municipal auditor is the allowance that should be made for depreciation when preparing the balance sheet of a civic enterprise. Civic enterprises are now fairly numerous and also dissimilar in character. For example, many cities have one or more of the following:—waterworks, electric light works, hydro-electric works, street railways, gasworks, abattoirs, ferries, telephone systems, docks and harbours, high pressure fire pumps, asphalt works, hospitals, schools, etc. In addition to these there are portable machinery of many kinds. The lives of the component parts of the foregoing enterprises vary and each undertaking requires to be dealt with separately.

There are several difficulties to be faced when the depreciation of any plant has to be ascertained. The defining line of depreciation to differentiate it from maintenance, renewals, and repairs is sometimes not easy to establish and therefore each unit must be taken into consideration and the accounts carefully analyzed. The engineer must consequently use his judgment as to what is depreciation and what is maintenance when any expenditure may be allocated to either account.

Actual depreciation and theoretical depreciation are seldom analogous. The actual depreciation of new and substantial plant is small in its early life and increases in after years, but theoretically it is necessary to equalize as far as possible the waste in the value of any asset on each year's operations. The depreciation of reservoirs, dams, docks and buildings will be small and fairly uniform, but parts of electric and gasworks, pumps, street railways, etc., depreciate more quickly and irregularly. Much, however, depends on the character and the extent of maintenance and the care with which the plants are operated. Excellent machinery placed under the control of careless or incompetent men may suffer more seriously than an inferior plant supervised by able men. Moreover some machinery and processes are liable to be changed owing to unanticipated developments and improvements, long before the expected life has been exhausted. In other works obsolescence and supercession should in many instances be provided for. Apart from depreciation, etc., there are occasions where reserve funds would be very useful, for it is unwise to increase the loan debt when by judicious building up of a reserve fund many contingencies may be met. This has been done in many places. A portion of the income in good years is set aside to build up a reserve fund up to a maximum of say twenty per cent. of the total capital expenditure. Such a fund is available to meet deficiency in the income of the undertaking or to pay off extraordinary claims or the cost of reinstating certain works destroyed by fire, accident, or which have become inadequate or obsolete. The city of Leeds (England) obtained powers in 1905 to create a reserve fund on the above lines, and the British Model Gas Bill as amended in 1913 has a provision for the same object.[1]

Every prudent municipal financier will endeavor to arrange that civic enterprises will each year bear their own fair share of liabilities, such as depreciation, etc., or arrange for the period of repayment of the loans to be equal to the equated life of the plant for which the money has been obtained.

When any city has expended on new works to the full extent of the power granted by law, then in Great Britain "any further borrowing power required to replace obsolete assets or outlay before the original loan is repaired have to be granted by Parliament, and very severe scrutiny is made into all the circumstances because the grant of further powers will lay a double burden upon the community until the original loan is repaid. All this tends to support the present practice of Parliament, namely to fix the period of repayment at a number of years well within the life of the asset; in other words, to make the annual charge for the redemption of debt a little more than equivalent to the normal rate of depreciation which could be charged to revenue, or profit and loss, account by a prudent trader?"[2]

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[1] Gas World, Feb 28, 1914

When loans are obtained for longer periods than the actual or equated life of any plant, then the question is how to provide for the liabilities already mentioned. This is a matter which requires careful consideration for on this depends the adequacy or otherwise of the funds.

In Great Britain the Local Government Board decides the period of repayment of municipal loans and these are fixed according to the nature and quality of the works for which the money is required. Omnibus loans are not usual, that is loans for a variety of works having a great range of durability are not usually added together. For instance, a waterworks scheme may include land, masonry dams, reservoirs and mains, pumping machinery, meters, etc. The probable life of each component part is different and the period of repayment therefore varies. A street railway scheme will ordinarily comprise land, power plants, buildings, rails, wires, cables, poles, cars, etc. The expected life of these may range from a minimum of say six years to a maximum of any number of years, for land usually will not depreciate. Loans are either sanctioned for each item so as to secure the maximum period of repayment in each class, or the life of the composite scheme is ascertained and loans sanctioned for such periods. The results in these cases is that depreciation is ordinarily covered because the entire cost of the plant must be repaid in the estimated life of the plant and consequently the risks to the investors are reduced and they are prepared to accept a lower rate of interest.

In the United States, loans are sometimes negotiated and the number of years in which they have to be repaid are fixed regardless of whether the works involved will have an equal life. When any part of the undertaking has become distressed by wear and tear, or has become inefficient or inadequate or obsolete in a less time than the period for which the loan has been contracted, then another loan is often obtained and the utility has to carry more capital than it should legitimately be charged with. This has gradually created a situation that is neither satisfactory to the public nor the investors, hence the reason for the creation of about 43 State Commissions to control this matter.

In Canada, there is tendency towards American methods of financing utilities. There are instances where the cost of certain works and machinery have been distributed over a period during which renewals will probably occur more than once. If the public authorities charge such renewals to revenue, or if a reserve fund is created to bear the cost of the same, there can be no serious objection, although it would be better to fix the time for the retirement of the loans equal to the life of the plant. If on the other hand any plant, appliances or machinery which become worn out before the repayment of the loans and there are no funds other than a fresh loan to meet the cost of such renewals then the utility is not operated on good sound financial basis, and this may in time operate to the disadvantage of the utility.

The Local Government Boards which will sanction municipal loans and Public Service Commissions for other public utilities, will no doubt inquire into applications for authority to borrow or issue bonds and thus safeguard public credit. In this connection it will be useful to quote Wall Street Journal:—

"There are few States in which Public Service Commissions have not been established by law, and while there was a time when they were looked upon as hostile to the capital invested in the companies, it is beginning now to be realized that they tend in actual practice to protect the companies as well as the public. The regulation by commissions is protecting the security of the investor in public service bonds and stocks. They offer one of the most inviting forms of investment that can be found." The article is too long to quote fully. "These bonds suffer less than any other class from the periodic reactions in general trade," is the testimony of Mr. Lawrence Chamberlain in the same Journal.

Having regard to what has been stated, it will be apparent that where works are executed and the equated life of the same do not correspond with the period of repayment, then it is reasonable to suggest that depreciation should be provided in some way to make up the deficiency.

"Investors in public utilities at least under normal conditions are entitled to have their investments kept intact. If they are not within reasonable limits assured of this the necessary capital will not be forthcoming. These conditions prevail regardless of whether the plants are privately or publicly owned."[3]

"The term depreciation, though not strictly accurate was originally applied as a convenient form of expression of the phrase 'diminution of value due to wear and tear.' It covers, however, other and wider contingencies. The question of depreciation cannot be separated from that of maintenance, and in theory one may be said to balance the other."[4]

"Depreciation is generally due to causes which may be classified under ordinary wear and tear, general decay, obsolescence and inadequacy."[3]

"Depreciation is concerned with the allocation to each year's operating accounts of the waste in the instruments of production attributable to the year's operations. The cost of materials purchased and entirely consumed in the course of the year's operations is invariably included in ordinary operating expenses."[5]

The question often arises as to the method by which depreciation should be provided, whether by equal annual amounts, by sinking fund, by annuity, by uniform annual investment charge, by Dollar-year method or some other arrangement. This is a matter for the Engineer and the Accountant to consider. There are strong advocates of each method. The Wisconsin Railroad Commission and other Commissions generally adopt the straight line method of equal annual instalments, that is, the original cost of the plant, less its estimated residual value at the end of its life, is divided into equal annual payments to the fund. The sinking fund method is largely used in Great Britain and by many authorities on this side of the

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(2) Repayment of Local Loans, by Edward Hartley Turner, 1913.

(2A) See Report of Select Committee of British House of Commons, 1902.

(3) Address on Depreciation, by Mr. Halford Erickson, of the Wisconsin Railroad Commission, 1912.

(4) Depreciation, by Ewing Matheson, 1910.

(5) Depreciation and Public Service Regulation by R. W. Witten. Engineering News, May 8th, 1913.

Atlantic. Amounts are set aside annually and invested in some approved securities or used in building extensions, etc. These amounts placed at compound interest will in the aggregate be equal to the cost of the plant less its scrap value. The annuity method consists of setting aside a sum for repayment, and interest, which together are the same each year, but as the interest decreases the repayments increase. The uniform annual investment charge is fully explained by Mr. Whitten in the Engineering News. It is assumed that the depreciation reserve is invested in the undertaking, and becomes an integral part of the investment. It is practically the same as the sinking fund, except that the latter fund is usually invested in other securities at a different rate of interest to the rate of return from the business the capital of which it will ultimately repay. The dollar-year method involves the classifying of various parts of a plant according to their durability, and then the number of times each class of machinery, etc., must be renewed in the life of the most durable class is ascertained. The total cost of all the renewals in each class during the life of the longest is computed and these costs multiplied by their lives will give the total dollar-years. When the total dollar-years for all classes is divided by the total cost of all renewals during the period then the quotient obtained represents the composite life of the plant.

The New York Electric Railway Company provide for maintenance and depreciation combined by setting aside a sum of money based on car mileage; other companies deduct a percentage on gross earnings. Some electric light and power authorities base the renewals and depreciation on the monthly output in kilowatt-hours. Other companies having a large and permanent plant are able to dispense with the depreciation charge because there is a wide annual average deterioration on the whole plant and the annual expenditure on renewals maintain the undertaking at approximately a constant value. For instance, in a concern where a large number of boilers, engines and generators are operated, instead of creating a depreciation or reserve fund any boiler, engine or generator becoming inefficient is scrapped and replaced by a new and better unit, out of revenue.

In smaller undertakings—and these constitute the major number of undertakings and involve a large investment in the aggregate—it will be possible to find funds to meet renewals, replacements, depreciation, only by an annual or more frequent contribution made out of revenue to provide for such purposes.

Caisson Type of Infiltration Reservoir at Sarnia, Ont., Waterworks

By H A. McLean, Town Engineer, Sarnia

No municipal undertaking contributes more to the comfort and well-being of the residents than the development of a pure water supply. Sarnia is just now completing an entirely new plant which medical and engineering experts affirm will furnish "the best water in the world." This plant is located where the waters of Lake Huron enter the River St. Clair. It consists of the pumping station, infiltration reservoir and force main.

This main is over two miles long and enters the present supply main of Sarnia at the corner of George and Front streets. It is 24 inches internal diameter and is 5-16 inches thick. The steel is made by the Siemens-Martin Open Hearth process and the pipe is lap-welded. The minimum lengths are 26 feet and the joints are of the bell and spigot type. The joints average 5¼ inches long and are caulked with 3¾ pounds of oakum and 45 to 50 pounds of lead. The bell is reinforced by turning a flange on the pipe 1½ inches in width. To protect these pipes from corrosion they are dipped when at a temperature of 300 degrees Fahrenheit in a rust-resisting solution of the same temperature. They are then wrapped in burlap and re-dipped in an asphalt solution. This insures a double coating for the inside of the pipe, while the burlap serves the double purpose of holding the solution on the pipe and of being a protective coating. After being caulked, the joints are coated, wrapped with burlap and recoated with the solution. The pipe weighs 85 pounds bare and 88 pounds coated and wrapped.

The main is furnished at intervals with valves of the Ludlow type and is laid so that connection may be made for the village of Point Edward through which it passes. Two expansion joints serve to take care of expansion and contraction and also to facilitate making connections to the pumps and to the present mains. Special Y's are also laid in the main to allow cross connections being made when it becomes necessary to lay a duplicate main. The contract price for laying the main is $2.25 a foot and for the pipe itself $3.62½ a foot.

The power-house is situated on the beach of a bay where the tendency of the current is to build up the land. It consists of a coal room, boiler room and a pump room in which are the office and store room.

The coal room is 40 feet long and 42 feet wide and has a switch running to it. Two large sliding doors permit a car of coal being shunted right into it. No coal-handling device will be installed just now, as the boilers will be fired by natural gas piped from the Tilbury fields on the shore of Lake Erie, sixty miles distant. However, coal hatches in the roof have been provided to permit coal being unloaded from the vessels if the gas supply fails. A supply of coal will always be kept on hand in case of an emergency. The room is built of pressed red brick outside and common red brick inside, well reinforced with steel bands, and has a concrete floor and a concrete roof supported by steel trusses.

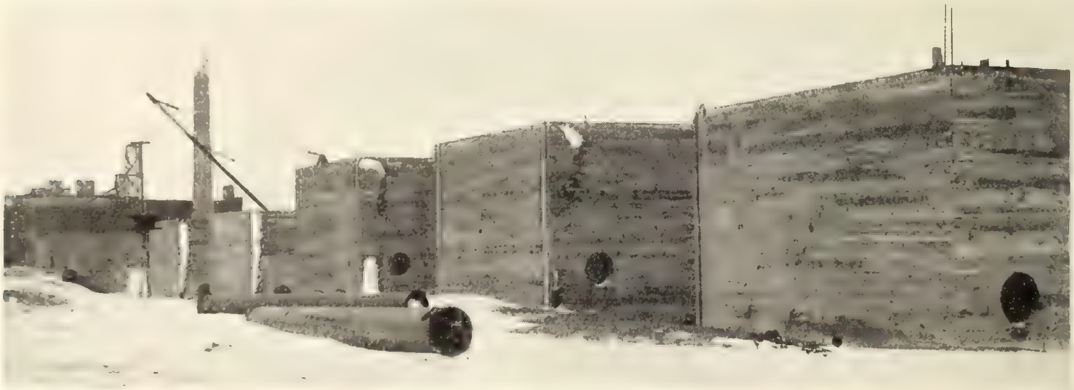
The boiler room, which is of pressed red brick both inside and out, is 45 feet long and 42 feet wide and is equipped with a battery of three boilers of 500 h.p. capacity. These boilers are of the return tubular type and are manufactured by the Waterous Engine Works. They are 72 inches in diameter and 18 feet long, built in accordance with the boiler regulations of the province of Ontario for a working pressure of 150 pounds and a hydrostatic pressure of 225 pounds a square inch. Each of these has 72 tubes, 4 inches in diameter, and the total heating surface of each boiler is 1,555 square feet. The grates are shaking grates, 66 inches long and 66 inches wide, and these are installed as gas requires a [illegible] wall [illegible] brick to break up the gas jet. Otherwise the flame would shoot

Lowering pump wells.

First chamber of basin in place.

through the tubes and up the stack, thus imparting very little heat to the water in the boilers.

The smoke stack is 100 feet high and 4 feet 6 inches in diameter. It is built of radial fire brick on a six-foot concrete foundation, 24 feet square. It is built on a compact bed of sand and gravel capable of sustaining a weight of 1½ tons a square foot. It is built by the Alphons Custodis Construction Company, of Chicago.



Chambers of basin ready for lowering.

The pump room is built of pressed red brick outside with pressed buff brick inside and is 64 feet long and 50 feet wide. In it will be installed a duplicate set of turbine pumps driven by steam turbines supplied by the Canadian Allis-Chalmers Company, Toronto.

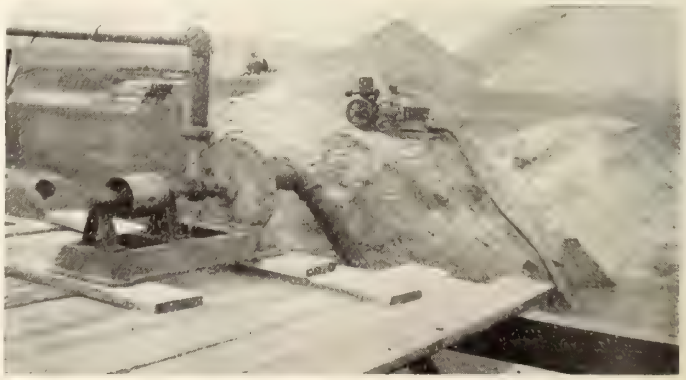
The rated capacity of the steam turbines is 250 h.p. each at 3,600 r.p.m. when operating under the following conditions: (a) steam pressure at turbine 150 lbs. per guage; (b) superheat at turbine 0 degrees Fahrenheit; (c) back pressure 0 lbs. per guage; (d) vacuum at turbine reduced to 30 inches; barometer 28 inches mercury.

The turbines are of the impulse type with two complete stages and are designed for direct connection to the pumps by means of reduction gears. Operating condensing the steam consumption, exclusive of that used by the auxiliaries, is 15 pounds per b.h.p. hour at full load.

Each turbine has a set of double helical reduction gears capable of reducing the speed from 3,600 r.p.m. down to 1,450 r.p.m. and is capable of safely and continuously transmitting 260 b.h.p.

The pumps are high lift single stage turbine pumps of the Mather and Platt design and are capable of delivering 3,000 imperial gallons a minute against a total head of 199 feet, including a suction lift of not more than 22 feet when running at a speed of 1,450 r.p.m. The power required by each pump is 230 b.h.p. The suction pipe is 22 inches in diameter and the discharge pipe from each is 14 inches. The guide or

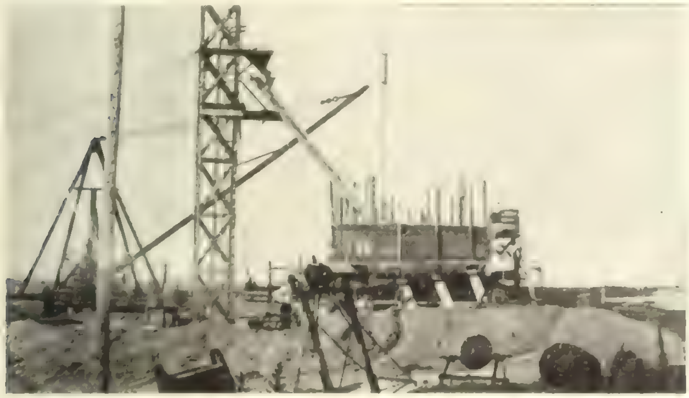
Lowering basin and section.



Testing filtration of water through different strata.

diffusion vanes are made of phosphor bronze and are removable and easily replaced. The impellors are also made of phosphor bronze and are of the enclosed type. Removable neck rings are fitted on each side of the impellor to prevent leakage of water back to the suction port of the impellor. Each pump is designed to pump 4 1-3 million gallons per 24 hours against a pressure of 86 pounds for domestic service and for fire service to pump six million gallons against a pressure of 120 pounds. Each set is designed to amply take care of the ordinary consumption and one is a duplicate of the other. For fire consumption, however, the pumps are run in series. This arrangement gives the most economical results, a saving of 10 per cent., as the water-works system is a direct pressure system and the full load capacity of the pump is more nearly attained than in any other way. The bed plates and shafts are so constructed that motors may be installed later on if Sarnia adopts the use of Niagara power.

The condenser is a surface condenser of the waterworks type and is installed on the suction pipe. The water is drawn through a bank of condensing tubes and is pumped directly into the force main. As this main lies in a water-bearing stratum the temperature of the water delivered to Sarnia consumers will be the same as if any other type were used. The condensed steam is returned to the heater by a 6-in. x 14-in. x 10-in. single acting Edwards air pump installed in the condenser pit.



Method of pouring concrete. Sarnia waterworks.

A 24-inch Venturi meter tube is installed in the force main just outside the power house and a type M. Register, Indicator Recorder is installed in the pump room.

Two pump wells, 25 feet long, 8 feet wide and 22 feet deep, are located underneath the pump room and two just outside. These are built with reinforced concrete bottoms and are so constructed that the power house may be extended at any future time as the consumption increases.

The infiltration basin is built in twenty sections 25 feet square and 19 feet deep. These sections extend 18 feet below the water level. A concrete building 6 feet high extends over all and the two pump wells besides. This is equipped with a ventilator and manhole for each section, and a steel gallery 3 feet wide resting on the top of the section runs the whole length.

The basin is constructed 100 feet from the shore line in a bed of gravel 60 feet deep and this forms the bottom of the reservoir. The water percolates through this bed into the basins. As the current in the River St. Clair at this point is from 5 to 8 miles an hour the gravel is kept continually washed free of all silt. This method of slow sand filtration has been approved by the Ontario Board of Health and saves Sarnia $100,000 in initial cost as well as the cost of washing the sand, if any other sand filtration plant were installed.

In constructing this basin and pump wells, each alternate section is built above the water line and allowed to stand until thoroughly seasoned. Then the gravel is excavated from the inside by means of a clam-shell bucket dredge. The section settles down as the gravel is excavated until it reaches the proper level. The bottom is then made up of a layer of stones not exceeding 2 inches in diameter. For the intermediate sections concrete slabs are built which overlap the basins on each end. These have grooves moulded in each end which correspond to similar grooves in the sections previously sunk and are sunk in exactly the same way. Each end of the slabs and the basin has two-inch wooden rubbing strips 1 foot wide secured to the concrete by bolts to decrease slipping friction. When all are in place the grooves are tamped full of concrete to form a water-tight joint.

A steel pipe with a 24-inch valve in each section extends through the basin and pump wells so that the flow from each may be regulated. These valves are operated by a hand-wheel from the steel gallery.

The cost of the plant is as follows:—Force main, $87,000; power house, $33,000;; infiltration basin, $65,600; boilers, etc., $7,000; pumping machinery, etc., $22,000; engineering, etc., $12,000; total, $226,600.

A recent survey has demonstrated clearly what was previously considered probable—the practicability of constructing a bridge on the rocky reef called Adam's Bridge, which connects the island of Ceylon with the mainland of India. The distance is 22 miles, and an estimate has been made giving the cost of the work, which probably includes a good deal of causeway, at about $4,000,000—an amount much less than was previously thought necessary. There is, therefore, a probability of this important connection being carried out in the near future. A part of it, from the main land to the island of Rameshwaram, has in fact been built. The immediate utility of such a bridge is much diminished by the fact that while the main-line railways are uniformly of 5-ft. 6-in. gage, the gage of the Adam's Bridge branch is narrower. Hence the excellent harbor at Colombo would still lack suitable connection with the rest of India.

A company of British engineers and others interested in Canadian transportation were entertained at dinner in the Savoy Hotel, London, Eng., on April 30 by the Montreal Harbor Commissioners, of whom Mr. Cowie, the chief engineer, acted in the capacity of host. Referring to the investigation being made by the Commissioners, Engineer Cowie said they were inspired by the competition and also by the investigation of Canada's rivals for European trade. On the other hand, the economical working of the port in Montreal had attracted engineers from Europe and America.

Mr. Hugh L. Cooper, of Rochester, Minn., builder of the big dam across the Mississippi river at Keokuk, Iowa, has been appointed by Sir Ralph Wilcocks, supervising engineer of the famous Assouan Dam, as consulting hydro-electric engineer for the Egyptian Government. Mr. Cooper will have supervision of the construction of the dam across the River Nile, which it is said will be one of the largest dams in the world

A Retrospect of Municipal Engineering Practice in 1913

By the London, Eng., Correspondent of the Contract Record

MUNICIPAL engineering practice covers such a wide field now that it would be difficult to deal, within the compass of a readable article, with the entire range of subjects embodied in the expression. Some line must be drawn, if the article is not to become heavy and unwieldy, and it is therefore proposed to retrospect only so far as highway construction and maintenance, water supply, sewage disposal, (which may be taken to include sewerage) and refuse destruction are concerned. These are the primary duties of a municipal engineer, and apply equally whether he holds an important borough appointment or is merely the "surveyor and inspector" to a small urban or straggling rural district. Such works as those in connection with housing, hospitals, schools and so forth, call for architectural training and experience, and although duties in connection with them are frequently added to those legitimately his, the services of an outside architect (except possibly in the case of county schemes) are often requisitioned either to do all that is required or to co-operate with the engineering official. The past year has witnessed the completion of many large schemes, but individual reference to these will not be made, a catalogue being quite a different thing from a retrospect.

Highway Construction and Maintenance

It is customary in considering this subject to commence with some such expression as "the rapid development of self-propelled traffic during the past few years" or " the wear and tear caused by high-speed mechanical traction," and to point as a moral the numberless problems which have confronted the engineer in his endeavor to cope with such disturbing elements. The one thing that is certain is that the highway engineer has been placed upon his mettle by the new traffic, and that the methods of the erstwhile road-foreman-surveyor have had to go by the board.

The International Road Congress

The most important event of the year 1913 was undoubtedly the International Road Congress held in London. Here were collected data and statistics relating to highway engineering and administration in all parts of the civilized world, and if the number of papers was excessive and the treatment of the various subjects was occasionally diffuse and the translations left something to be desired, there was yet a residue of good sound stuff which well repaid study—especially when served up in the condensed form adopted by the Contract Record.

Terminology and Classification

Terminology was one of the matters dealt with in the Congress papers, and a tribute must be paid here to the admirable glossary (reproduced in the columns of the Contract Record) which has since been prepared by Mr. Percy Boulnois. That there are faults in the glossary and that it leaves out much that should be included and includes much that is redundant, does not militate against its usefulness. The criticism it has aroused is the strongest evidence that could be adduced in its favor, and when the glossary appears finally in book form it will, there can be little doubt, prove itself one of the notable achievements of 1913, its year of inception. The classification of the chief road stones, undertaken by the Engineering Standards Committee on Road Materials, deserves at least passing mention as being the inaugural step towards a complete classification of materials. The subject was dealt with in an article, "Standardization of Road Stones and Standard Nomenclature," which appeared in the Contract Record of October 1st last.

The Road Board Trials

A great flourish was made at the International Road Congress regarding the trial sketches of various forms of road construction which were laid, under the supervision of the Road Board, at Sidcup and elsewhere. Many visitors were deluded into visiting the site and the motor omnibuses on the favored routes did a roaring trade. Optimists have expressed the conviction that the present year may bring to light some practical results from these trials, but the practical man (who is not necessarily pessimistic by-the-bye) is of a different opinion. It may seem a harsh thing to say, but these belauded trials can no longer be regarded in any other light than that of a huge joke. That they were well-meant none can deny, but good-meaning and incompetence only too often go hand in hand in this life, with regrettable results. An interim report of these trials was issued by the Road Board last year, but it was for the greater part valueless. Some of the materials laid have since had to be relaid, many of them have had to be repaired, while in some instances (in one at least) one material has been replaced by another. Unsuitability for the traffic conditions obtaining on the trial stretch must be the final report as to quite a large proportion; indeed the matter could now be decently interred and put away from sight and memory for ever without a pang of regret from any sane-minded individual.

Road Engineering

Road engineering, in the true meaning of the term, does not exist in England. What undeveloped tracts of country there may be are not in the market for development, and the supply of roads is in the main fully adequate to meet requirements. New roads come into being only in the case of estate development and present neither engineering features nor difficulties. There are certain road schemes for London being discussed now, notably the western approach road to London and the Croydon relief road, and both of these will certainly fall within the category of engineering works, but they are the exceptions and—they are only schemes at present and have not yet materialized. The extension of town planning will doubtless in time call for the construction of many important highways, but town planning is not making much headway against the red-tape restrictions and harassing requirements of the Local Government Board. There is no greater anomaly than the number of Acts which are passed by the Legislature only to be rendered null, void and of no effect by the very Departments and officials created to popularize them and assist their working. A rapid descent in the scale must now be made to

Road Crusts and Carpets

and the question naturally arises, why not "linoleums" and "oilcloths," having regard to the oiled and similar surfaces that abound? It may be said at once that the year 1913 has brought nothing new in either good crusts or carpets. There has been an enormous amount of nonsense talked on the subject, with just a leavening of real commonsense, and one contemporary in particular has been feeding its readers almost entirely upon road crusts. That the subject has its importance it is unnecessary to say, but it has its limits, and there are other subjects that deserve at least some slight share of attention. When a writer descends to measuring the depth and area of the pittings made upon a road crust by rain, it is very nearly time for the operation of some Mental Deficiency Act in his case. There are three primary methods of surfacing a macadamized road: Surface painting, tar macadamizing and pitch grouting. Other methods are variants of these, as are the numerous proprietary systems, such as pitchmac, tarmac, rocmac, ferromac, lithomac, cormastik, plascom macadam, roadoleum, and tarvia. There is no doubt something in all of them, and improvements are made in their composition and laying as experience is acquired; but nothing of a startling nature has been accomplished in this way during the past year, owing, it may be, in some instances, to perfection having been obtained! At least, so we are told in more than one catalogue issued for the coming season. As regards tar painting and tarred materials in general it must be noted that the increase in the cost of tar is becoming a serious matter. Its price is several times what it was in the early days of these systems, and unless some other material comes to hand the cost of such work must become prohibitive. There have been no noteworthy improvements in road machinery since the exhibition which was held in connection with the International Road Congress, although some interest attaches to the three-axle roller designed by Colonel Crompton. This roller is designed to give pressure ranging from 160 lb. to 500 lb. per inch width of roller.

Town and City Roads

Tar macadam is being used in vastly increasing quantities in residential quarters and in business streets where the traffic is fairly light. The tendency to substitute granite setts for wood and asphalt pavements in busy thoroughfares has become more marked during the past year, but there have been no actual conversions worth recording. In wood paving creosoted soft woods chiefly are employed, to the possible exclusion in time to come of the Australian hardwoods. In quarters where the motor traffic is heavy, such work has had to be done in strengthening the foundations of the roadways, and this has been found to result in a saving of maintenance costs. Brick pavements have not yet caught on and their use is practically confined to footways, channels and crossings. The use of rock asphalt has increased much during recent years, and last year formed no exception.

Water Supply

Among the more important events in water engineering the installation at Chingford of the Humphrey pump by the Metropolitan Water Board must occupy a prominent place. The pump is of the internal combustion type, in which the explosion of gas takes place in direct contact with the water to be lifted, and upon which it exerts the force necessary for raising it. The Board, after a most thorough investigation, decided to adopt this pump, and the installation at Chingford has a total capacity of 180,000,000 gallons per 24 hours, with a lift of from 25 to 30 feet. Five pumps have been erected in all, four with a 40,000,000 gallon capacity and one with a 20,000,000 gallon capacity per day. The column of water in the "play-pipe" oscillates to and fro according to the stroke of the pump, and a large conical water tower above the outlet makes good the fluctuating levels of the water, and so maintains a continuous discharge to the high-level reservoir. Anthracite coal is used for the producer gas, with a guaranteed consumption of 1.1 lb. per actual water horse-power, and with this at 22s. per ton the fuel cost of pumping would be .0196d. per 1,000 gallons lifted.

Water Purification

Under this head there is nothing of a definite nature to record. The good work is forging steadily along, and advances have been made both in purification and sterilization of water by the use of chlorine, by treatment with hypochlorite, ozone and the ultraviolet rays of light, and by mechanical pressure, filtration and oxidation. It would be superfluous to deal with these in detail, all the processes having received a due share of attention in the Contract Record and other technical journals during the past year. A great deal of attention has been paid to treatment with lime, for softening, sterilising and purification purposes. "It is evident," says an authority on the subject, "that lime is not only useful for softening water; it is useful also when added to water containing carbonic acid in neutralizing the acid and in removing plumbo-solvent qualities; further, if added in proper proportion, it will prevent the corrosion of iron pipes, it being found that the thinnest possible film of lime acts as a preservative." Mr. G. C. Whipple, in a paper read before the New England Waterworks Association, dealt with the addition to plumbo-solvent waters of lime in the form of powdered chalk. The manufacturers of softening plants are now claiming the merit of sterilization for their processes. The Metropolitan Water Board is still pursuing its researches, under the able direction of Dr. Houston, into the purification of water by sand filtration and storage. One week's storage is said to increase the safety of the water over a hundredfold, while the uniformity obtained in the quality of the stored water assists the efficient working of sand filtration beds.

Mains and Structures

The causes of the incrustation of water mains and of animal and vegetable growths in water mains have received considerable attention, as has also the subject of external corrosion. Steel mains are coming to the front, although the demand of the Local Government Board for repayment within a short period of loans for these mains has restricted their use. A great amount of steel pipe is exported from this country to the Colonies. Reinforced concrete is another material for which the Local Government Board will not grant long-period loans, with the result that its use for reservoirs and other waterworks structures has been considerably curtailed. An important report on the subject of cracks in reinforced concrete has been drawn up by the Concrete Institute. It is interesting to note that water may in swimming baths be used over and over again if properly purified. The

Belfast Corporation had, in July last, a public bath which had not been completely emptied and refilled for seventeen months, only sufficient water to make up for loss having been added from time to time. Bacterial analysis showed the water to be as pure as the town drinking supply.

Sewage Disposal

In his presidential address delivered last year before the Association of Managers of Sewage Disposal Works, Dr. Bostock Hill laid stress upon the necessity for co-operation between the chemist, the biologist and the engineer, and in this direction much has been done during the past year. The problems of sewage disposal have proved to be of a highly complicated nature, and it is being realized, none too soon, that there is no royal road to the disposal of sewage, each individual case calling for special treatment. There are adherents of slate beds, septic tanks and so forth, who claim practically their all-sufficiency, but any such claim is sheer nonsense. The past year has been one of steady progress, of grappling with difficult problems, of trial and experimentation galore; but the finger cannot be laid on any specific performance of outstanding importance. The literature on the subject has been voluminous, and a number of huge schemes—notably those of a joint sewerage scheme for Greater Vancouver and for Greater New York respectively—have received their due share of consideration.

Royal Commission on Sewage Disposal

The Appendix to the Eighth report of this Commission was issued during the year, and the event must have a certain amount of importance. It is unfortunate that the Commission has been so long in issuing its reports, as the first must of necessity be more or less out of date long before the last appears. The Appendix contained a mass of information, together with records of practical investigations; and must prove very useful to the engineer who has time to study it. Possibly when the next report (which is to be the final one) has been issued, an intelligent and intelligible precis of the whole of the volumes may be looked for. It will be possible, perhaps, to boil them down into the compass of quite a small book. In America investigation of every kind is proceeding apace, and records are being made and data established that puts into the shade the work done in any other country.

Dilution

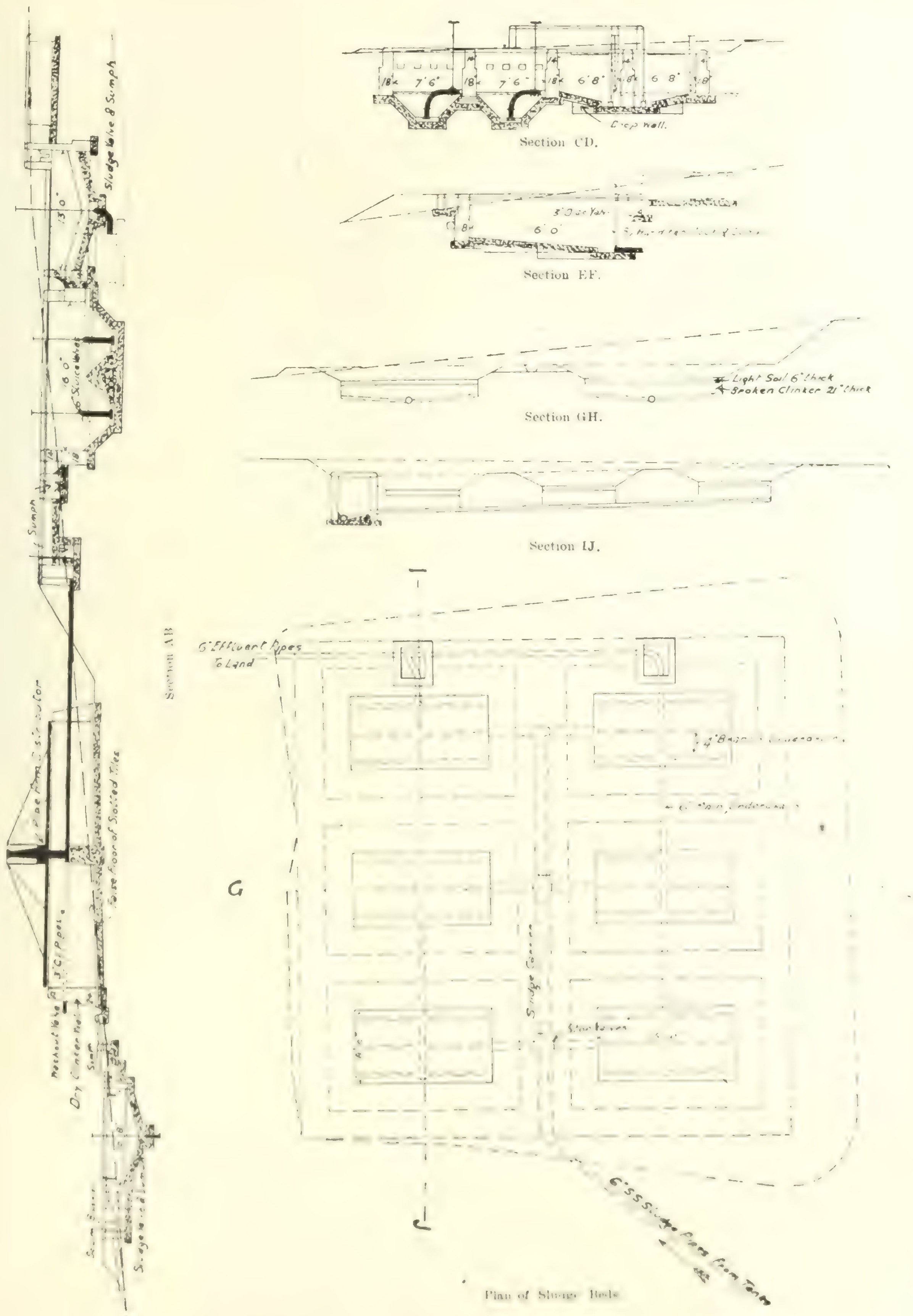
The question of disposal by dilution has been largely discussed but it has not found much favor in England. The Royal Commission on Sewage Disposal did, in its Eighth Report, extend its patronage to it, when the dilution was not less than 500 to 1. "The ratios of dilution recommended as the chief factor to be considered in dealing with settled sewage appear," says an authority on the subject, "to be perfectly safe." These observations are based upon the records of experience in America, where crude sewage has been discharged into large bodies of water where the volume, as in the Great Lakes or in New York Harbour, has been ample, but the lack of suitable currents has had the effect of causing the deposition of heavier solids in large quantities or the drifting of the lighter floating solids into positions where they have created a nuisance. Even in otherwise well regulated streams the unavoidable slackness of flow at the sides, or in weir-pools and in very dry seasons, has also caused the suspended solids to be deposited in such quantities as to form large accumulations of putrefying organic matter, which has inevitably given rise to serious nuisance in the form of objectionable smells, as well as exhausting the dissolved oxygen in the water and thus rendering it unfit to support fish life." One cannot agree with Mr. G. W. Fuller, a member of the American Society of Civil Engineers, who considers that a 45 to 1 to a 90 to 1 dilution, depending upon the manufacturing wastes in the sewage and the dissolved oxygen content of the diluting water, would be sufficient to prevent nuisance to sight and smell, although where the bulk of the solids in suspension had been previously removed some such standard of dilution might suffice.

Methods of Treatment

There is nothing sufficiently novel in the methods of treatment obtaining to call for special notice. Dr. Bostock Hill, in the address already mentioned, definitely expressed himself as in favor of circular percolating filters, of a standard depth of 5 ft., with material about one-half inch in size, although a little finer on top. It is too early yet to pronounce finally upon such details; but the one fact remains that, in this country, although contact beds continue to give good effluents preference is given in new works to percolating beds. The fixed spray jet is being largely adopted in America for percolating beds. Simple land treatment in England is dead, the Local Government Board not being prepared to entertain proposals for broad irrigation, no matter what amount of land it may be proposed to allot for the purpose.

Sludge Disposal

Sludge disposal still receives its meed of attention, but it remains a very acute problem indeed, and is the cause of more trouble to the engineer than any other feature of sewage disposal. The conversion of sludge into a saleable manure that will pay for the labor expended upon it seems beyond the reach of practical economics for the present. In May last, Dr. Grossmann, of Manchester, read a valuable paper on his system of sludge disposal. Sludge, he pointed out, contained nitrogen, phosphates, potash, all good for plant food, and yet it was not a good manure owing to the presence of grease which prevented the access of air and water to the soil, and also rendered impossible the solution by rain of the valuable ingredients. In his system (which has been working satisfactorily at Oldham for some time) the grease and certain solids are removed, leaving a valuable dry powder of high manurial value, portable and easily handled. Unfortunately, he cannot claim a profit on the process, but he is prepared to undertake that the cost of getting rid of the sludge altogether would not be more than the present cost of converting it into pressed cake. In America the Imhoff tank has found great favor. The tank is designed to reduce the bulk of the sludge and to digest it down to an easily handled residue of an earthy nature suitable for manure. Important developments in sludge disposal may safely be looked for in the course of the next few years. When once commercial enterprise enters the field, it is pretty obvious that there will be some practical results, and already several companies are making arrangements to take over the total output of sewage from selected works for the purpose of utilizing it in various ways. Dr. Grossmann's is a case in point, and others—the Native

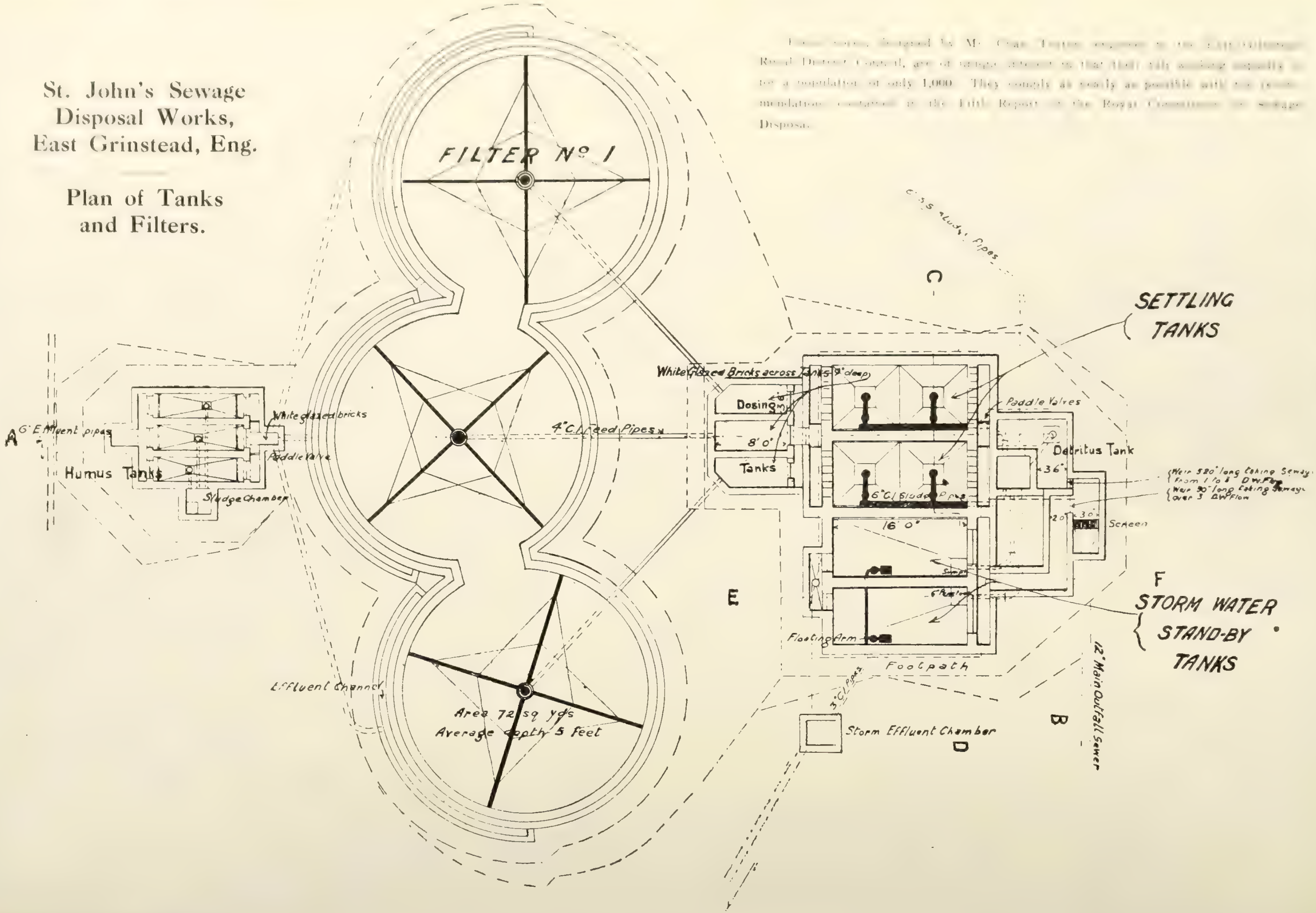


St. John's Sewage Disposal Works, East Grinstead, Eng.

St. John's Sewage Disposal Works, East Grinstead, Eng.

Plan of Tanks and Filters.

These works, designed by Mr. Chas. Tupper, engineer to the East Grinstead Rural District Council, are of unique interest in that their daily working capacity is for a population of only 1,000. They comply as nearly as possible with the recommendations contained in the Fifth Report of the Royal Commission on Sewage Disposal.



Guano Company, for example, who are at work at Kingston-on-Thames—could be given.

Refuse Destruction

The expression "refuse destruction" must be taken in its widest sense, and not limited in its application to the process of incineration in specially constructed furnaces. There are—as residents of numberless rural districts in all parts of the country know to their cost—other methods of incineration, and an excellent specimen of "how not to do it" may be seen in operation now at a certain straggling village in Middlesex. Here some thousands of tons of London "rough dust" are being shot on the land and burned, the stinking smoke being visible to both eye and nose for miles around. Possibly about one-tenth of the refuse will be wholly or partially consumed, and the remainder will be spread over the ground as a foundation for choice building sites. The village, by-the-bye, is one of those miserable little "urban" districts which were created by the Act already referred to. There is not a street in the district, and its total population is only about 700. It forms a good dumping ground for London's waste material, as its staff are too busy diagnosing sore throat as diphtheria and gravel rash as measles to pay much attention to the health of the district.

Scientific Incineration

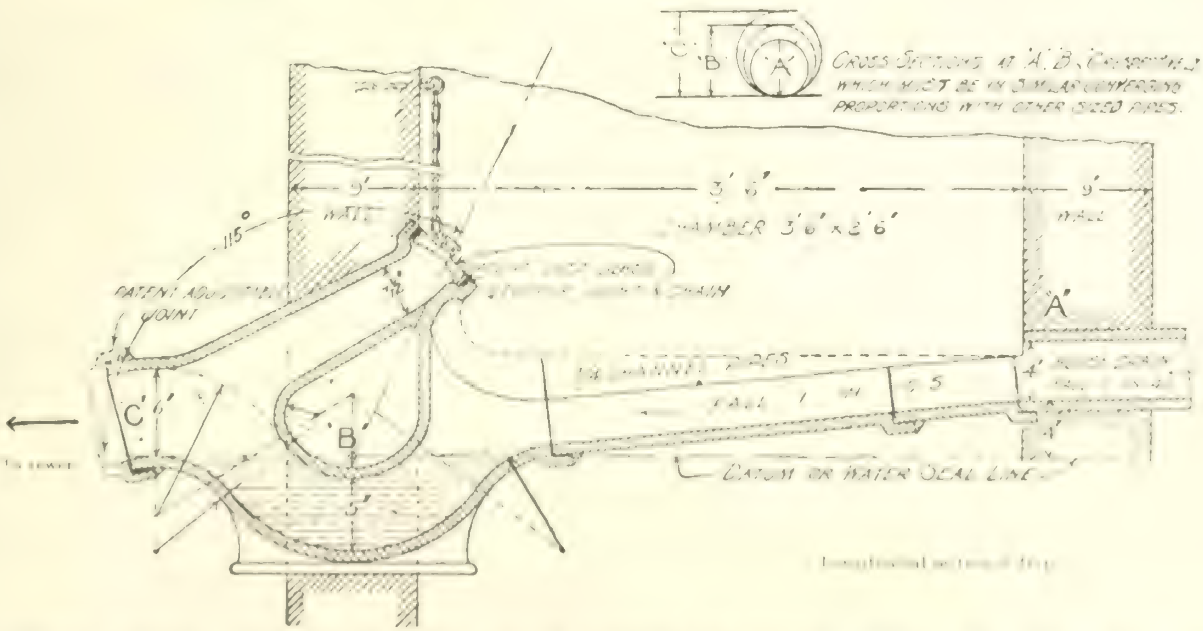
There has been no direct advance in the methods of legitimate refuse destruction during the past year, but the work has steadily progressed in the direction of increased furnace efficiency (tending towards economy of maintenance and better combustion), elimination of smoke and dust, more sanitary handling of the refuse and fuller utilization of the by-products. The arguments regarding the relative merits and demerits of front, top and back feed respectively still go on. Much nonsense was talked years ago as to the profits to be derived from the scientific burning of refuse. Although much has been done in the way of obtaining power for pumping, lighting and other purposes these profits have yet to be realized. The most that can be expected is a reduction in the cost of disposal, and this coupled with the mere fact of disposal itself, in a sanitary manner, is a great forward step.

Other Methods

The spreading of house refuse to a depth of 5 feet on the land of a sewage farm, and then running the sewage upon it for purification does not appeal to the imagination, although the system has apparently worked well at Leek, England, where the land available for irrigation was quite unsuitable for the purpose, owing to its stiff nature. The addition of the refuse to sewage sludge, the mixture being used as manure, is an undesirable form of disposal that has not only been advocated but actually put into practice, with results of a somewhat fluctuating nature. Apart from proper incineration, the direct conversion of the refuse into manure appears to be the best system extant. At Southwark, London, the "Patent Lightning Crusher" system has been in use for years, with excellent results, and many of the largest towns have now adopted it. The process is simplicity itself, and is absolutely free from nuisance, while farmers are ready purchasers of the manure.

Security of Tenure

For many years now English municipal engineers have been endeavouring to obtain superannuation and security of tenure. The sanitary inspector is the only individual who has anything of the kind, and his benefits are limited to security of a sort. His appointment is subject under certain conditions to the sanction of the Local Government Board, and his dismissal follows the same course. Thus, if his council decide to dispense with his services, he has at least the right of


Cross Sections at A, B, C respectively
which must be in similar proportions
proportions with other sized pipes.
C
B
A
9'
3' 6"
9'
Wall
Wall
Chamber 3' 6" x 2' 6"
115°
Patent joint
A
C
B
5"
4"
4"
5
Fall 1 in
Catch or water seal line
to sewer
Longitudinal section of trap

[illegible] glass stopper chained so that if it be blown out by any sewer gas pressure, it cannot fall into mouth of trap, and even if stoppage should [illegible] appeal to the Board, although the value of this is apt to be overrated. The life of a man whose retention in office was forced upon a council would scarcely be a bed of roses! Still, there is something in it, and there might be much more if the Board would exercise their full powers and would regard the inspector as their own servant.

The demand for security of tenure is a demand for the barest justice. No public officer should hold his appointment subject to the whim and caprice of a local body, the members of which only too often have a personal axe to grind. The resolution passed recently by the Wallasey Town Council: "That in future, if any official makes any application for increase in salary, contrary to Standing Order No. 54, and without his application being accompanied by his resignation, as provided for by previous resolution of this committee, such official be given notice to terminate his engagement," affords a glaring instance of the insecurity of an official's tenure. The Local Government Board have been appealed to on the matter and their views are as follow: "The Board are aware of no sufficient reason why any officer who thinks himself entitled to an increase of salary might not make application to the Council on the subject. It would rest entirely with the District Council to decide whether or not they would entertain the application, but the Board consider the Councll could not legally enforce a regulation that before asking such application the officer should place his resignation in their hands when he holds a permanent appointment or an appointment for a fixed period." The unfortunate thing is that the vast majority of officers do not hold a permanent appointment or an appointment for a fixed period. They are many of them subject to the shortest notice, and in numerous districts appointments terminate each and every year and re-appointment has to be made annually.

During the past year nothing worthy of record has been done by municipal engineers towards obtaining either superannuation or security of tenure. The matter has practically been left to the National Association of Local Government Officers, with whom the two municipal engineering institutions are affiliated, and there it rests. A Bill is to be presented to Parliament some day, and it will meet, it is pretty clear, the fate of other measures of a similar tendency. Municipal engineering officials are sunk in a hopeless apathy, from which it is impossible to rouse them. They badly want superannuation—the cry is raised at meeting after meeting—and they absolutely refuse to raise a finger to help themselves. Still more do they want security of tenure—cases of flagrant injustice are constantly being discussed on the platform and in the press—and each and every man sits supine, awaiting his turn with the fatalism of a Chinese coolie. There is only one thing that will arouse them and that is to compare their professional societies with trade unions, arguing that only by strong combination (such as prevails in the trade unions), by agitation (such as is carried on by the trade unions), by something akin to equality in membership (such as obtains in the trade unions), will their grievances receive redress. Such wholesome advice will lash them into fury, because—it would be laughable were it not so tragic—their dignity has been touched. The child who stretches out his arms to grasp the moon has as much chance of getting it as has the municipal engineer of being granted either superannuation or security of tenure.

The Engineering Activities of the Department of Marine and Fisheries

By Lieut.-Col. Wm. P. Anderson, C.M.G., M.Inst. C.E., Chief Engineer

THE Chief Engineer's Branch of the Department of Marine and Fisheries is charged with the expenditure of the annual vote of the Government for the construction of aids to navigation, and finds that, in common with all other branches of the Government service, the duties are increasing rapidly with the growth of the country. Of late years the tendency has been, not so much to increase the number of aids to navigation, as to improve the efficiency of those already established, and especially to strengthen the lights and fog signals to meet the increased demands caused by the growth in tonnage and speed of modern steamers. Lights are now required to be picked up at greater distances than previously, and greater range of audibility is also asked for in fog alarms. A great many of the old wooden lighthouse buildings are being replaced by structures of reinforced concrete and of steel.

The fact that lighthouses are usually located on the most prominent headlands, and consequently on the points least accessible from the land side, presents many interesting and difficult engineering conditions, and in many cases, especially in British Columbia, the physical obstacles to be overcome are very great. At Langara, on the northwest extreme of the Queen Charlotte islands, the clearing of the site, the preparation of a landing place in a somewhat sheltered cove, and the building of a corduroy road from the landing to the tower, cost far more than the actual construction of the buildings. At Cape St. James, at the south extreme of the same group, the lighthouse is perched on the summit of a rock that rises to a height of 200 feet out of the Pacific ocean, and an inclined tramway had to be built from a little cove at the base of the rock to the summit. This is operated by a donkey engine at the lighthouse, which, now that the work is finished, has been left for the handling of supplies.

The scenery at both extremities of the Queen Charlotte group is wild and grand, but the conditions are utterly desolate. The rocks at the foot of the cliffs are the abode of countless sea lions, and the crannies and summits provide nesting places for innumerable sea birds.

At many light stations it has been necessary to build breakwaters, roads, and bridges, and to solve other engineering problems raised by the roughness or inaccessibility of the site. Fig. 1 shows a light suspension bridge built in St. Paul Island to allow the lightkeeper to reach the main islaid, as the sea is frequently too rough to admit of launching a boat. This bridge was designed and erected under the supervision of Mr. J. A. Leger, Resident Engineer of the Department at Halifax. Its span is 190 feet. The towers, of structural steel, are 32 feet high. The main cables are of plough steel, ⅞-inch in diameter, carried over the tower on roller bearings and anchored to eye bolts fastened into the solid rock. The wooden floor is suspended on half-inch round steel rods clamped to the cables and stayed with half-inch wire cables, three on each side.

On the St. Lawrence River a complete system of range lights has been established and all lighthouses on this stretch, where the sites happen to come on the low bank, have been built on high piers designed to protect the towers from the great rise of water that occurs during the winter freshets, and especially when the ice is running. (See Fig. 2.) The foundations are made of ordinary concrete in mass. The modern range light buildings throughout the St. Lawrence ship channel are built entirely of concrete or steel. Some of the back towers are carried up in skeleton framework to a height of 100 feet above the ground.

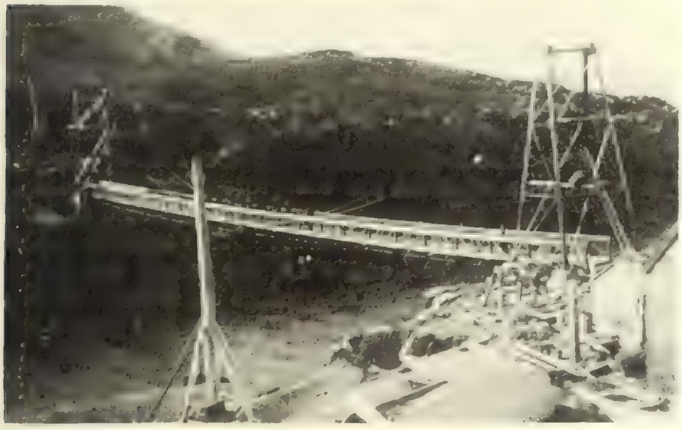


Fig. 1. Suspension bridge, St. Paul Island, illustrating difficulties of access to light stations.

In these towers the framing is made of angles, with the butts usually bolted to gussets, and in many cases the steelwork is galvanized after being shaped and fitted. It is our practice to make the framework heavier than the stresses demand, for the sake of securing rigidity against vibration of the illuminating apparatus. Usually these towers are surmounted by a wooden watchroom and lantern. It is our experience that woodwork removed so far from the dampness of the ground is practically as durable as the steel.

During the past season a new channel for shallow draft vessels has been completed from Repentigny to Lavaltrie. The axes of the tangents of this channel are marked by range lights, one of which is illustrated in Fig. 3, showing a skeleton steel frame carrying a day beacon and surmounted by a locomotive headlight lantern. These ranges are erected cheaply and prove very efficient. They are adapted for removal every winter, as the ice run during the spring freshet passes several feet over the piers.

All reinforced concrete towers are surrounded by buttresses to reduce vibration. It is found necessary to make the columns much stronger than theoretical requirements demand, for the purpose of securing steadiness in high winds.

Such concrete buildings are usually founded on solid rock, the vertical rods used for reinforcement being anchored into the rock. The rods reinforcing the buttresses are carried through the towers to make a solid bond from side to side through the floors. In some cases flying buttresses (Fig. 4) are used, the effect of them being light and artistic. Experiments are being made with a view to securing a dense and white surface on the exterior of these concrete towers, but no thoroughly satisfactory waterproofing has yet been found.

Lenses for illuminating apparatus have to be procured from England or France, but the metal lanterns, pedestals, revolving gear, lamps and other equipment for anadian lighthouses are being built more and more in Canada, and some very compact arrangements of clock-work and revolving gear have been installed lately. Some parts are secured from private makers by contract, while the remainder are built at the Department's Lighthouse Depot at Prescott, where every complete installation is assembled and tested before being sent to its station. All important apparatus are now illuminated by means of petroleum vapour burned under incandescent mantles.

The use of unwatched lights is increasing, especially in British Columbia waters, where it is difficult to secure keepers. These unwatched lights consist of lens lanterns supported over gas receptacles. In some of the lights, calcium carbide is used, the acetylene being generated automatically in small quantities as required for service. At other stations, a compressed oil gas or acetylene gas dissolved in acetone is utilized. Most of these beacon lights will burn for from six months to a year without attention, and have the additional advantage that they can be placed in position at short notice. It is probable that this system of lighting will be utilized for Hudson Bay and Strait in the near future. The use of acetylene dissolved in acetone on the Aga system seems at the moment to be giving the greatest promise of success, principally because it is not affected by extreme temperature conditions.

The Department has adopted the diaphone, of which the patents are controlled by the Canadian Fog Signal Company, of Toronto, as its standard fog alarm. Preference has been given to this instrument because its sound is the most penetrating yet devised and also because it is less apt to get out of order than the siren. In the diaphone, a loose piston moves backwards and forwards, air under compression escaping through slits in the piston and its jacket from a receptacle behind. The air is brought up to 25 or 30 lbs. per square inch—found to be the most economical pressure—by standard compressors, usually operated by internal combustion engines, though occasionally steam or electricity is used for the motor power. The compressed air is delivered to the diaphone from large reservoirs, so as to minimize the drop in pressure.

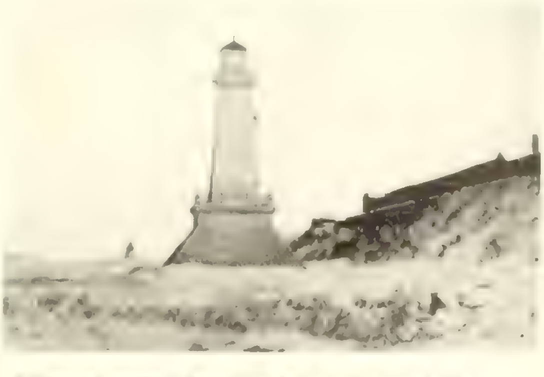


Fig. 2. Reinforced concrete lighthouse, Montreal harbor, built on mass concrete pier, designed to resist heavy ice shoves. Erected under winter conditions. In spring the water rises to top of slope on pier.

A small electric installation established recently in the beacon house at the extreme end of the breakwater in Port Stanley has given great satisfaction in consequence of its compactness and ease of operation. The motor is controlled by a switch distant one-half mile from motor. The current is three-phase, 25-cycle, 220 volts and actuates a combined motor and compressor manufactured by the National Brake Company, Milwaukee, which delivers 11 cu. ft. of free air per minute. The air is stored at 30 lbs. pressure and is supplied automatically at stated intervals, to a 1-in. diaphone instrument which absorbs 1 cu. ft. of free air per second of blast. Since the plant was put in operation last autumn it has run practically without attention, and without any opening up of the building on the breakwater.

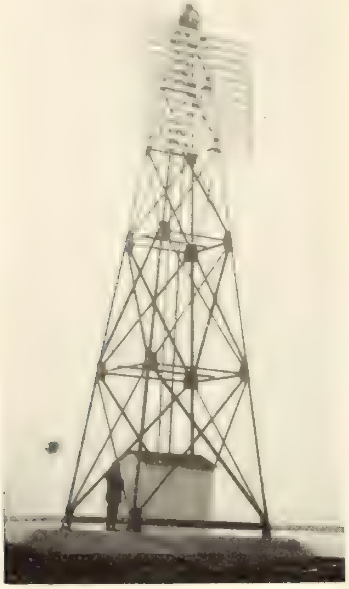


Fig. 3. Skeleton steel tower in Repentigny channel, designed for removal in winter to avoid ice shoves.

A number of submarine bells will be esablished during the coming season. In past years, experimental stations were established at which submarine bells, connected electrically and operated by dynamos on shore, were tested out, but it was found that this arrangement was not reliable and that the work of repairing breaks was difficult and tedious. The plan has now been adopted of attaching the submarine bells to buoys and operating them mechanically by power derived by the motion of the buoy on the waves. This system is much simpler and much less liable to get out of order than the electrically-connected bells. The advantage of the submarine bell signal is that water being of constant density the range of audibility through that medium remains constant and there are no aberrations of sound such as are always experienced with fog signals transmitted through the air.

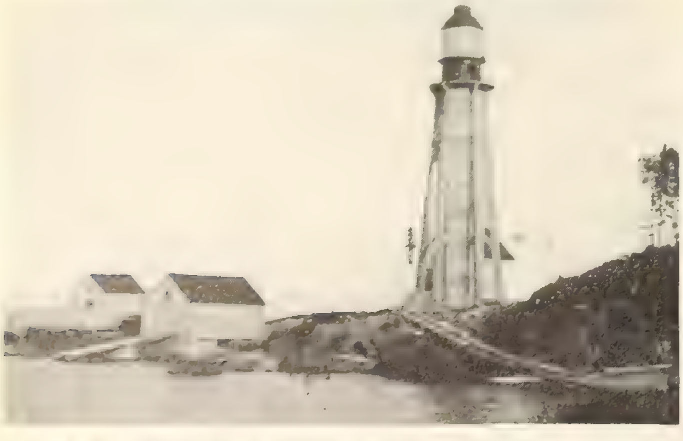


Fig. 4. Michipicoten east end lighthouse, showing construction in reinforced concrete, with flying buttresses.

The Department is now occupied in establishing depots for buoy work or for lighthouse service in different centres of the country. A new depot (described in detail by the author in the 1913 Annual Number of the Contract Record) has recently been established near Prince Rupert, B.C., and another, for buoy service only, at Amherstburg, Ont. The Prescott, Ont., depot, which is the principal depository of lighthouse supplies, has been greatly enlarged and improved. New sites have lately been secured at St. John, N.B., and Victoria, B.C., and work on the building of wharves at these depots is in progress. At St. John, the wharves are required to be extremely high to allow of the flotation of vessels of twenty feet draft at extreme low water, as well as to provide for a rise of tide of twenty-six feet. The wharves are therefore over fifty feet in height. These wharves are being constructed of concrete in mass with earth filling. At Victoria, where there is no ice to contend with, the wharf will probably be of piles creosoted to protect them from teredo.

The Department of Marine and Fisheries is now cooperating very cordially with the Department of Public Works in the improvement of channels. Whenever the Department of Public Works does any dredging it furnishes the Marine Department with full details of the work accomplished and the Marine Department provides the necessary aids to navigation to mark the improved waterway. A large number of buoys, day beacons and range lights, usually of small value, but aggregating a considerable expenditure, have been established during the past year and a continuation of this work is contemplated during the present season.

An interesting duty of the Chief Engineer's branch is the control of ice-breaking contracts for the purpose of prolonging the season of navigation, especially at the head of the Great Lakes. Last autumn very little work was required in consequence of the open season, but in the autumn of 1912 and spring of 1913 extensive operations were carried on at Fort William and Port Arthur, and in the Sault river, enabling vessels to transport wheat from the terminal elevators up to an unusually late date.

A 78-suite apartment house of brick and tile construction is to be erected at Winnipeg this season by Messrs. Oddson & Company, at a cost of nearly $250,000. The new building will be replete with all modern improvements in the way of fire escapes, telephone system, vacuum system, and so on. The foundation work is now in progress.

A rather unique problem confronting the contractor having under way the construction of houses to quarter the men engaged in building the gigantic tunnel through the Selkirk range of the Rocky Mountains at Glacier, B.C., was the drifting snow which made it almost impossible to proceed with the work in a satisfactory manner. As a consequence the idea was conceived of building a village on stilts. The floors of the houses are to be 8 ft. above the ground and the streets will have no sidewalks but there will be a walk in the centre also 8 feet above the ground level and connected with the doors of the several houses by little bridges.

Foundations of the Dam across the North Saskatchewan River at Lacolle Falls

By F. A. Creighton, Consulting Engineer, Winnipeg

THE series of rapids known as LaColle Falls is situated about twenty-five miles below Prince Albert on the North Saskatchewan River, continuing from this point to the junction with the South Branch, about twelve miles lower down stream. The total fall in this distance is about 95 feet.

A hydro-electric development, utilizing the upper portion of this fall, is being undertaken by the city of Prince Albert for the purpose of supplying power for general purposes. The development consists essentially of the following items: dam, navigation lock, intake works, head canal, power house, and tail race.

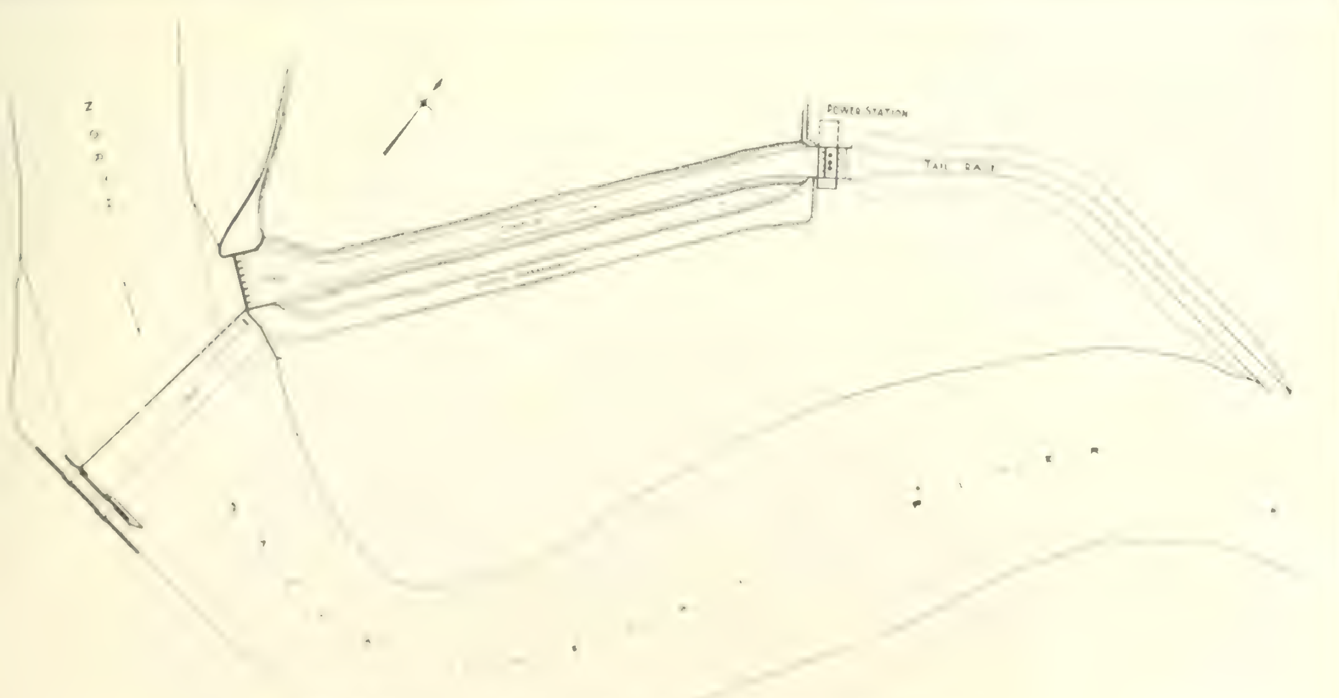
The portion of the river affected by the works is roughly five miles in length. The width varies from 500 to 1,000 feet and the fall is as great as ten feet in a mile. The general direction of flow is from west to east. The dam creates a head of from twenty to twenty-two feet and the river falls between the dam and the outlet of the tail race from six to eight feet, so that the developed head is normally twenty-eight feet.

The navigation lock is situated at the south end of the dam and is built as a component part of the structure. The intake works are at the north end of the dam, and are also built as a continuation of the dam structure. The head canal is cut in a northeasterly direction from the intake to the power house, a distance of about 2,000 feet. The depth of cutting varies from sixteen to twenty-five feet. The power house is situated on the flat 2,000 feet from the dam, its location being determined by the most northerly point at which a suitable foundation could be obtained. The tail race is 1,800 feet long, extending from the power house to a point as far down the river as it was economically feasible to go. The head canal, power house and tail race are built to develop 6,000 h.p. and are located for enlargement to 12,000 h.p. at a later date. The remainder of the work is built to what is intended to be its ultimate capacity.

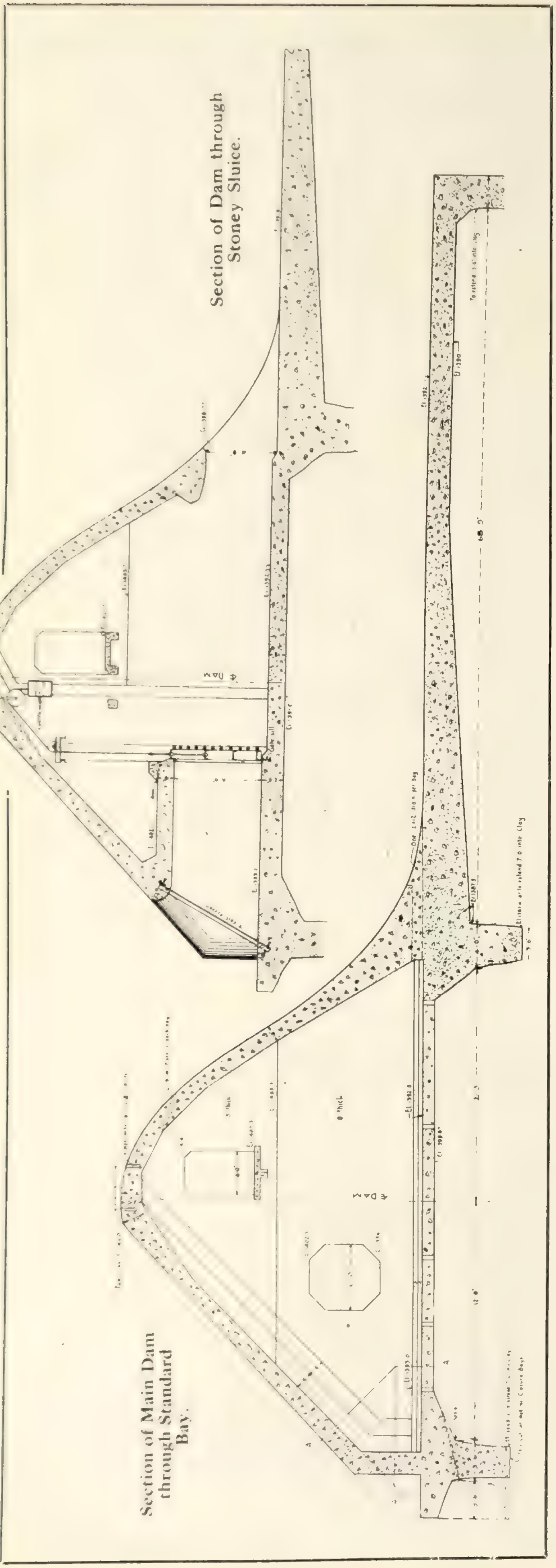
The distance covered by the work, from the extreme west end of the navigation lock to the east end of the tail race, is somewhat less than a mile. The general layout of the plant is shown in Fig. 1.

The Saskatchewan River at the point where the dam is being built is about 750 feet in width and the greatest depth at normal flow is about eleven feet. The normal summer flow of the river appears to vary between 20,000 and 40,000 cu. ft. per second, while a flow of 162,000 cu. ft. per second was observed in the year 1899. The surface elevation at normal water is 1400.00, referred to the datum used by the special survey being carried on by the Department of Public Works, this datum having been adopted and used throughout the work.

The governing elevations in connection with the work are as follows: spillway, 1420.00; flashboards, 1422.00; excavation for dam, 1389.00; bottom of cut-off walls, 1384.00; floor of dam and tumbling hearth, 1392.00; upper mitre sill of lock, 1416.00; lower mitre sill of lock, 1392.00; floor of intake works, 1406.00, bottom of canal at power house, 1405.00, and bottom of tail race at power house, 1385.00.



Plan of hydro-electric development at Lacolle Falls, North Saskatchewan River



Section of Dam through Stoney Sluice.

Section of Main Dam through Standard Bay.

The bottom of the river valley in the vicinity of the work has evidently been subjected to numerous local influences which have scoured the original formation and rendered the subsequent deposit most irregular and uncertain, and in nowise to be relied upon without a most thorough investigation covering all the ground which can in any way influence the stability of the work.

The selection of the actual site for the LaColle Falls dam was a long and tedious process and was only accomplished after six months of continuous exploration, extending for about three miles along the bed of the river.

The outfit used for this work consisted of: small single cylinder hoisting engine; duplex horizontal pump 2½-in. discharge; 15 h.p. boiler; hammer weighing 150 lbs.; sheaves, pulley and hoisting rope 1¼-in.; wrought iron pipe (heavy) 3-in., 2-in., 1-in.; and hose, tools, etc. The work was begun with one of these outfits, but it was afterwards found necessary to purchase another. The cost of an outfit ready to go to work was about $700.

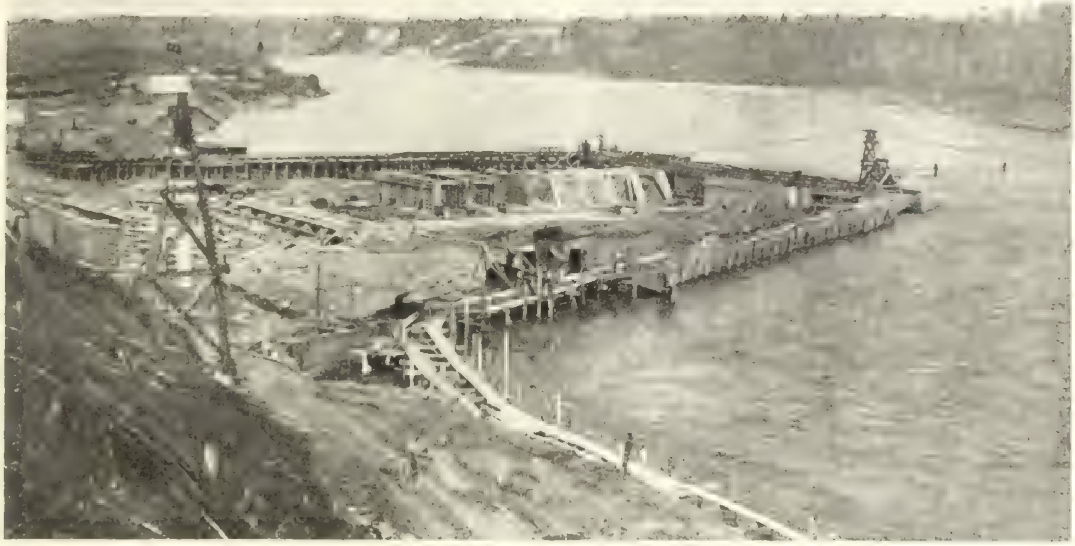
The method employed was to drive the 3-in. casing pipe into the gravel overburden by means of the hammer, which was raised by the niggerhead on the engine and dropped by gravity. The gravel inside the casing was washed out by means of the pump and the driving continued until clay was reached. The cores were taken through the clay by means of a 2-in. pipe driven inside the 3-in. casing. Only about 4-in. to 12-in. core was taken when the core pipe was removed and the core drawn out. It was always the endeavor of the operators to have the casing sealed in the clay to prevent the infiltration of the river water and so determine whether the clay stratum and contained sand pockets were absolutely dry or not. Holes were driven in this manner to a depth of 70 feet.

The results obtained from this method of examining earth foundations would appear to indicate that the test is a very severe one, and that any soil giving satisfactory results might be reasonably expected to improve on closer examination with pick and shovel.

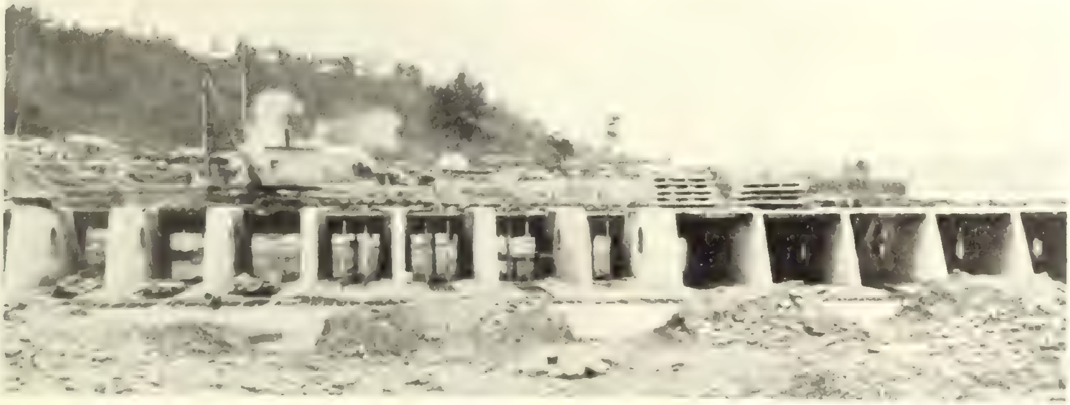
No Solid Rock Was Encountered

The underlying formation appears to consist of a very firm, hard and impervious clay carrying a certain amount of sand, with scattered particles of gravel. Boulders were rarely encountered in this clay. Sand pockets varying in size from a few cubic inches to a few cubic yards were common, but continuous strata of any material other than the clay were not, as far as it was possible to determine, encountered after the real clay was reached. The sand pockets encountered were invariably dry, showing that there could be no connection with the water of the river.

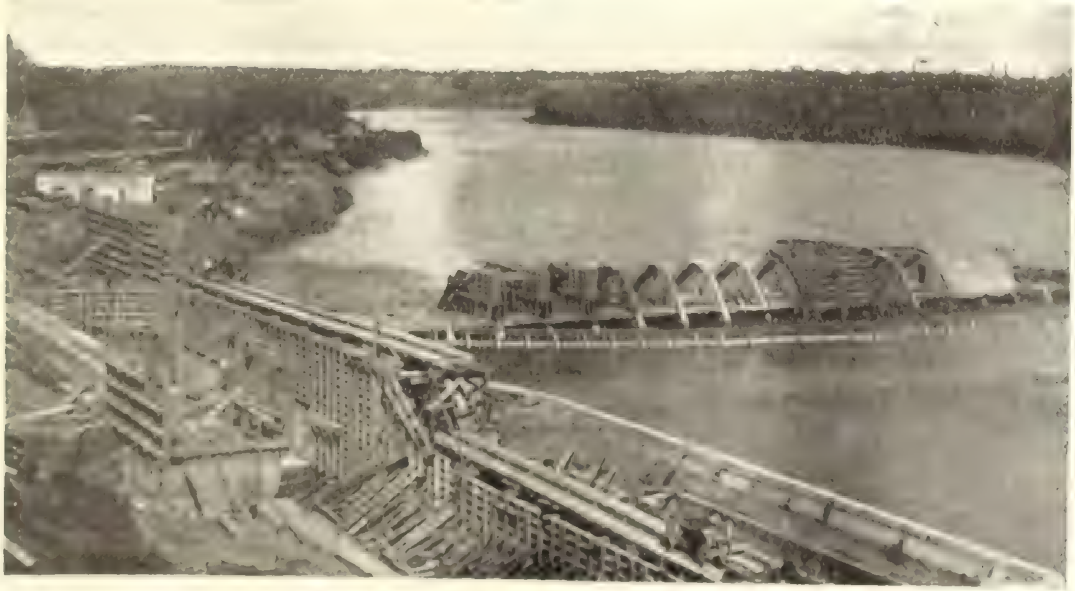
The boring operations, as above noted, covered a distance of about three miles along the bed of the river. At the first site selected as a possibility for the dam two borings were put down revealing a depth below water level of 70 feet of coarse gravel and sand, with hardly more than a trace of clay. As the borings were discontinued at this point it is not known at what depth a solid foundation might be found. A second possible site, situated about one-and-one-half miles below the first, was then prospected but the results obtained at this point were little better. A stratum of clay of a more or less impervious nature was found at a moderate depth, but the thickness was in places only ten feet and the sand and gravel under-



Coffer-dam, showing constructed portion of lock and dam.



Up-stream view, showing lower lift dam buttresses.



Lock and dam under construction. Looking up-stream.

Hydro-electric development at La Colle Falls. Lower lift, buttress 19, from north side of coffer-dam.

lying it contained water under a pressure head of about five feet.

The results obtained at the third, fourth and fifth possible sites showed a gradual improvement, but nothing upon which it could be considered safe to construct a dam under the required head without a prohibitive expenditure. The underlying clay was in no case found extending across the river valley at an elevation that could be reached at a cost at all commensurate with the earning possibilities of the scheme. At the sixth possibility, which is the site on which the dam is now being built, the surface of the clay was found to reach within a few feet of the bed of the river and was overlaid with only a few feet of boulders and gravel. This condition prevailed, however, only at the actual site chosen for the dam and for a very short distance up and down stream, from which points it fell away rapidly until at points 500 feet distant the covering would reach a depth of fifteen to twenty feet.

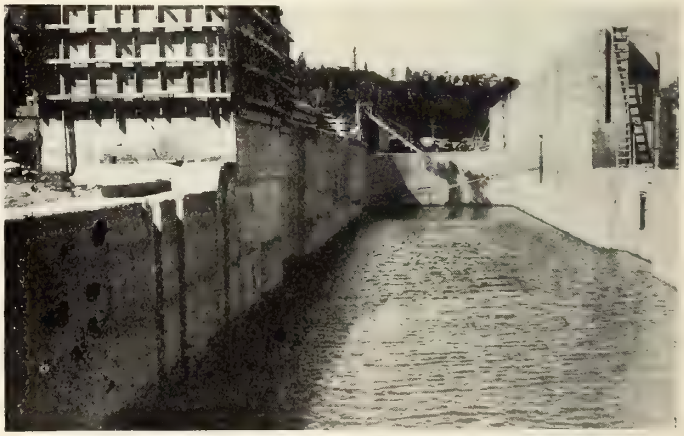
Having discovered a site upon which it appeared to be practicable to construct the dam, borings were put down in the following order for the purpose of proving beyond reasonable doubt that the deposit of impervious material was continuous: 1, centre of river at dam site; 2, centre of river 500 feet above site; 3, centre of river 500 feet below site; 4 and 5, each side of river opposite 3; 6 and 7, each side of river opposite 1; 8 and 9, each side of river opposite 2. These holes were all sunk to a depth approximating sixty feet, and the results shown were considered satisfactory.

Intermediate holes were then sunk at closer intervals to depths ranging from twenty-five to forty feet. On the site selected for the dam the spacing of the holes was less than fifty feet, and where an appreciable pocket of sand was discovered extra holes were put down to determine its extent. The real nature of these sand pockets, however, was not fully understood until after some of them were actually exposed in the excavation for the foundation. It was then found that they were of small extent and that there would be no difficulty in dealing with them so that the safety of the work would not be affected.

Hydro-electric development at La Colle Falls. End section, showing upper lift of buttress of dam.

The dam is of hollow reinforced concrete construction of the Ambursen type. A typical cross section is shown in Fig. 2. There are three cut-off walls, each thirty inches thick. One is located at the upper face, another at the junction of the dam proper and the hearth, and the third at the lower end of the hearth. These walls extend noramlly five feet into the clay, but in the even of a pocket of sand being disclosed, the walls were carried five feet beyond the limit of the sand.

The question of driving sheet piling into the bottom of the trench for the upstream cut-off wall as an additional precaution, was considered at some length, but it was decided that this was unnecessary. Ten weep holes per bay were left in the floor of the dam for the purpose of relieving any upward pressure which might develop. The floor of the dam is level throughout its length. The spillway section is 755 feet long, which includes the entire width of the river at this point. The navigation lock which is 150 ft. x 40 ft., inside measurement, is built as a part of the dam structure, the north lock wall forming the south end wall of the dam. The upper cut-off wall of the dam extends under the lock wall and across the lock under the lift wall and into the bank on the south side, the idea being to form a continuous cut-off and preclude any possibility of leakage, as it was fully realized that any leakage which was allowed to attain a flow sufficient to cause abrasion would soon develop considerable dimensions, and the resulting damage would be very extensive.



Hydro-electric development at Lacolle Falls. Lock from lower end.

At the north end the intake works are tied into the dam. In this case the cut-off walls will be continued along the retaining wall on the lower side of the canal, and if it should appear to be necessary when the bottom is exposed, sheet piling will be driven as an additional precaution against scouring. When the work closed down in the autumn of 1913 the lock was practically completed and the spillway section was

Hydro-electric development at Lacolle Falls. Upstream view of dam under construction. The suspension foot-bridge, which can just be seen in the illustration, was a feature of the constructional operations worthy of note.

built for a distance of 300 feet from the lock, or about three-fifths of the width of the river. About four-fifths of the floor of the intake was also finished. When the work is resumed the remainder of the dam and intake will probably be built in one cofferdam, and the flow of the river will be taken care of through the opening left in the south part of the dam.

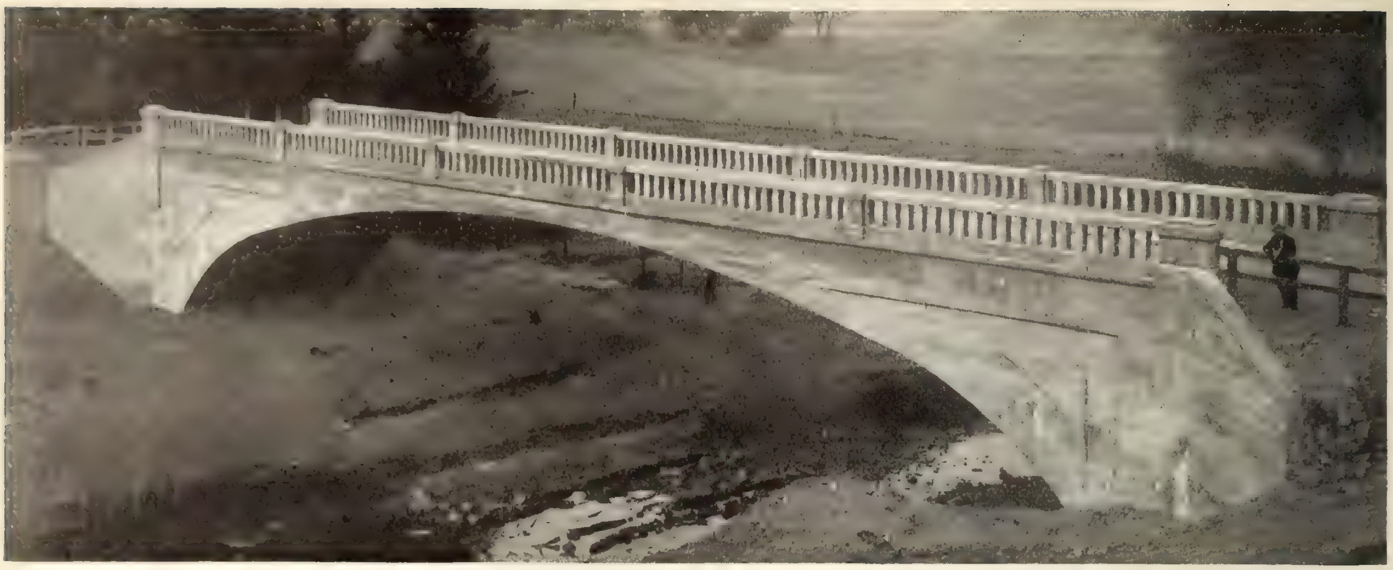
This work is interesting from the fact that it is a comparatively large and expensive structure built on a foundation which does not pretend to have the stability of solid rock, while the quantity of water which will have to be handled during extreme floods is enormous.

The conditions are somewhat similar to those obtaining at the C. P. R. irrigation dam across the Bow River at Bassano. The dams are of approximately the same size and design. While the foundations at La-Colle Falls are somewhat more stable than those at Bassano, the quantity of water to be handled at the former is more than double that at the latter. The best engineering talent in the country has been brought to bear on both pieces of work, and the results when put under actual operating conditions, will doubtless be watched with great interest.

Portland cement works with an annual capacity of 120,000 tons have been built at a cost of $700,000 at Aberthaw, South Wales, according to a recent consular report. The works have tidewater communications and adjacent thereto are quarries of argillaceous clay and limestone, said to be of the same quality as the deposits in the Lehigh Valley, Pennsylvania.

The total quantity of concrete laid in the Panama Canal and its auxiliary works to March 1 of this year is more than 5,000,000 cu. yds. This includes the work on fortifications, the Gatun Locks, the Pontoon barge piers at Baraiso, the Miraflores Locks and the Pedro Miguel Lock and dam.

Hydro-electric development at Lacolle Falls. Lower entrance of lock under construction showing portion of dam (on the right).



Lynhurst bridge, St. Thomas, Ont. (116 ft. span). The longest Canadian earth-filled arch.

Recent Developments in Concrete Arch Bridges in Canada

By Frank Barber[*]

EARTH-filled concrete arch bridges are being superseded by open spandrels to a considerable extent and the latter are being used on shorter spans than ever before. On the very long spans which are always associated with considerable rise from skewback to crown, economy makes open spandrels almost a necessity because of the great weight of the filling which would be required for the older style. All, or nearly all, of the concrete arches of over 175 ft. span have spandrel posts resting on the arch rings or ribs and supporting the floor system. In the last two or three years the advantages of the open spandrel have been so well appreciated by designers that it has been used on many shorter spans from 40 ft. to 100 ft.

The first Canadian arch bridge of this type was completed in 1910, and five have been built since, as given in the list.

In earth or sand covered arches the horizontal pressure of the fill against the arch ring, which may be as much as one-third of the vertical pressure, should certainly be allowed for in designing. In fitting the neutral axis of the arch to the line of resultant pressure, it is quite easy to take account of both the horizontal and the vertical thrusts of the imposed loads, but in analyzing the arch to determine the necessary and sufficient depths of ring from crown to springing, horizontal loads greatly complicate the problem. Besides this, the assumption as to the thrusts due to the filling are uncertain chiefly because the weight of earth varies with the time of year and the amount of moisture contained. But in the spandrel post arch the imposed loads on the ribs are all vertical and are definitely known. The solid arch ring of the filled arch generally becomes split up into two or more ribs in the open spandrel type. The greater depth of rib resulting from this is better to resist live loads but for temperature changes is not so well. At all events the ribbed arch allows the designer to pick out the economical form of section for the ribs, both as to depth and width, where in the older type he has no choice as to width of ring as it must be equal to the width of roadway. In the ribbed arch the floor is cantilevered out at the sides over the supporting posts, allowing narrow abutments and piers, the economy of which over the filled arch type is very evident.

Hinged or pivoted concrete or masonry arches are fairly common in Europe but not in America, and no example of them exists in Canada.

Doubtless existing Canadian concrete bridges will be greatly exceeded in size and importance in time to come. In order to show the development of the art at this period and for comparison with the list of open spandrel arches the list of filled arches has been prepared.

A variation of the common type of filled arch is what may be called the "horseshoe" arch. This has no spandrel walls and the concrete superstructure consists of the arch ring alone, which is made wide at the base and narrow at the crown to fit the fill. Consider, for instance, such an arch supporting a fill 20 feet wide on top with side slopes one and one-half horizontal to one vertical, the roadway being 12 feet from the natural ground at the water's edge. Here the arch ring would be 56 feet wide (measured parallel to the direction of the stream) at the skewbacks and about 25 feet wide at the crown, supporting only about 1 foot of fill over the crown.

The horseshoe arch is economical where the rise is considerable compared to the span. In one case, that of a full-centered arch, where the quantities were computed for both styles, the horseshoe arch contained 20 per cent. less concrete than the common form with spandrel walls.

An advantage of the horseshoe arch which is worth noting is that it can be correctly analyzed when built on the skew. The analysis of the ordinary skew arch is beyond the skill of present-day mathematicians. This was made clear by the report of the Commission who

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[*] [illegible] Engineer, Toronto. Engineer to York County.

Massey bridge.

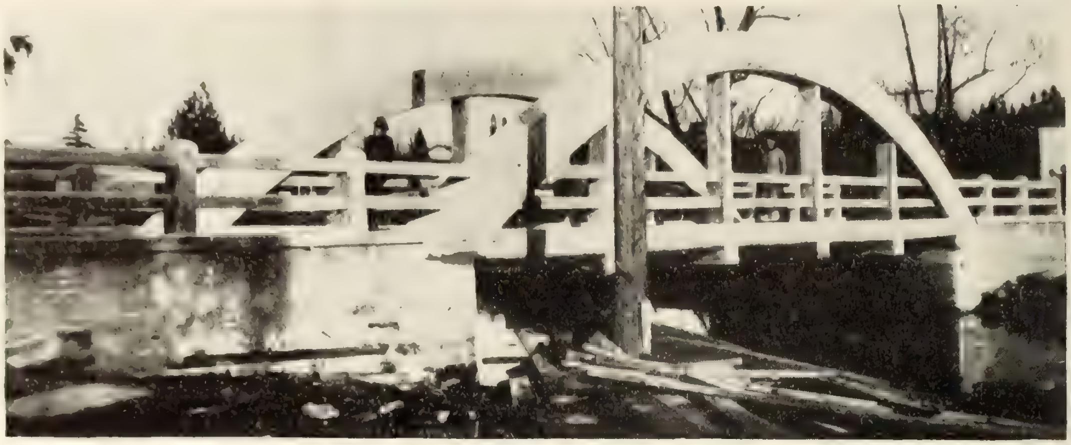
King George arch, Oakville, Ont.

Victoria bridge, Brantford.

Open spandrel arch, with clear span of 130 feet, built at Port Arthur, Ont.

Wadsworth arch, west approach.

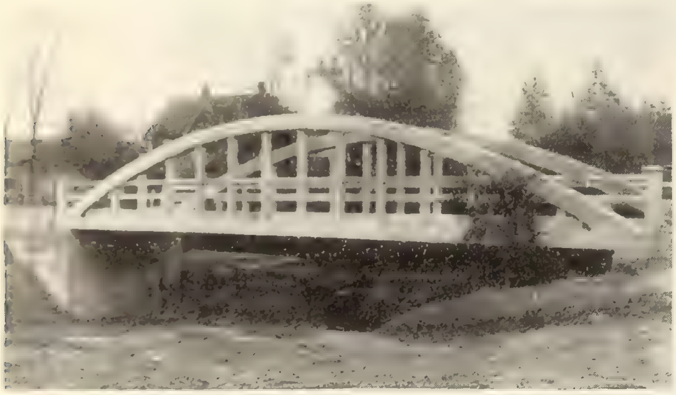
McConnel's bridge, "Horse-shoe" end.



Concrete truss, Wellington County, Ont.

examined into the causes of the failure of a large skew arch in Australia. But a horseshoe arch built askew contains a right arch.

Horseshoe arches have been built in Canada for the Metropolitan Railway at Newmarket, near Penetang, for Tiny Township, and between York and Markham Townships for the County of York.



Birrel's bridge, York Mills.

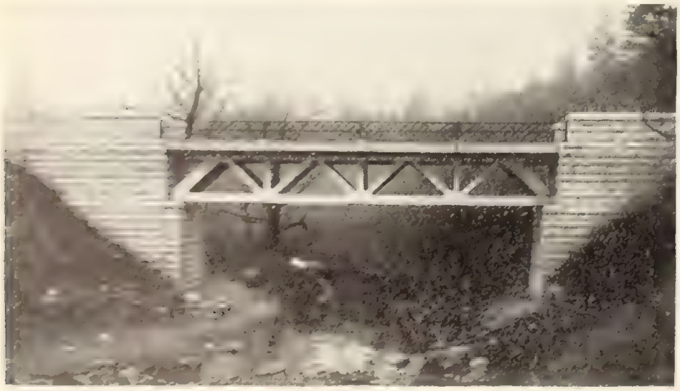
Canadian Open Spandrel Arches

	Clear span of main arch	Number of spans	Engineer
King George Arch, Oakville, Halton County, 1913.	135 ft.	9 spans Length 476 ft.	Jas. Hutcheon, County Engineer. Frank Barber, Consulting Engr.
Port Arthur, 1913.	130 ft.	1 span	L. M. Jones.
Wadsworth Arch, Weston, 1910.	18 ft. 6 in.	1 span	Barber & Young.
Fergus Bridge, Wellington County, 1912	80 ft.	1 span	Bowman & Connor, Engineers.
Kleinburg Arch, 1913, York Highway Com.	65 ft.	1 span	E. A. James, Engineer to Comsn.; Frank Barber, Bridge Engineer.
Victoria Bridge, Brantford, 1911, Market Street South.	60 ft.	5 spans Length 250 ft. Width 64 ft.	T. Harry Jones.

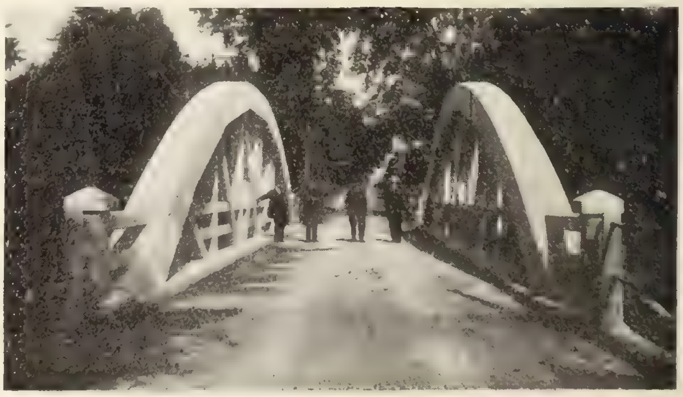
There are now ten examples in Canada of concrete arches with suspended floors, generally called concrete trusses. In this form of bridge the top chords are arched and their ends are usually tied by steel rods concreted over forming the lower chords of the trusses. These lower chords thus resist the horizontal thrust of the arched upper chords, where in the ordinary form of arch bridge the natural earth between and below the foundations must resist the horizontal pressure which tends to push apart the skewbacks of the arch and the abutments. In the ordinary arch the earth thus takes the place of the lower chord of a truss.

Where diagonals are used in the web system as well as lower chords to take up the horizontal thrust such bridges are true truss bridges, and where only vertical web members are used, they may be called trusses without diagonals.

It may be of interest to mention that a number of



Highland Creek bridge, Kingston Road, York County.



Freeman's bridge, York County.

such "trusses without diagonals," so-called by their designers, have lately been built in steel, either with or without arched upper chords.

Where the upper chord of a concrete truss is in the shape of a parabola, as is usually the case, the vertical web members are tension chords, and the diagonals, if any are used, are only stressed for eccentric loads and are thus in the nature of counter-braces.

A concrete truss bridge should be built at about the same initial cost as a good steel bridge with a concrete floor.

If the concrete truss bridges here illustrated had all been built upon masonry abutments of heavy coursed rubble, as in the case of the Highland Creek bridge, probably a more pelasing appearance would have resulted by reason of the contrast between the smooth surfaced superstructure and the masonry abutments.

Canadian Earth-Filled Arches

	Clear-span of main arch	Number of spans	Engineer
Lynhurst Bridge, near St. Thomas, Elgin County, 1909.	116 ft.	1 span	Jas. Bell.
Coaticook, Quebec, 1912.	100 ft.	1 span	
Bridgewater, Hastings County, 1913.	100 ft.	1 span	Lucius E. Allen.
Bancroft, Hastings County, 1913.	100 ft.	1 span	Lucius E. Allen
Massey Bridge, Ontario Govt., 1906.	92 ft.	1 span	W. A. McLean, Prov. Engineer of Highways.
Queen's Bridge over Kettle Creek, Elgin County, 1908.	80 ft.	2 equal spans	Jas. Bell.
Spry's Bridge over Moira River, Hastings County, 1913.	80 ft.	1 span	Lucius E. Allen.
Peterborough Arch Bridge		3 spans	T. S. Hay.
Brewery Bridge over Kettle Creek, Elgin County, 1908.	75 ft.	1 span	Jas. Bell.
Orwell Bridge, Elgin County, 1908.	75 ft.	1 span	Jas. Bell.
Kirkham Bridge, Scarboro Tnp., 1910.	70 ft.	1 span	Frank Barber.

Concrete Truss Bridges or Arches with Suspended Floors

	Clear-span	Engineer
Freeman's Bridge over Rouge River, York County, 1911.	91 ft.	Frank Barber
Middle Road Bridge, over Etobicoke River, Counties of York and Peel, 1909.	79 ft.	Barber & Young
Eckardt Bridge near Unionville, York Highway Commission, 1913.	70 ft.	E. A. James, Engineer to Comsn.; Frank Barber, Bridge Engineer.
Birrel's Bridge over River Don, York Township, 1913.	65 ft.	Frank Barber.
Simpson's Bridge, Amaranth Township, 1912.	60 ft.	Frank Barber.
Highland Creek Bridge, York County, 1912.	60 ft.	Frank Barber.
Bridge near Collingwood, Simcoe County, 1912.	55 ft.	R. H. Jupp, County Engineer; Frank Barber, Consulting Engineer.
Lower Haliburton Bridge, Mun. of Dysart, 1911.	55 ft.	Frank Barber.
Wellington County, 1913.	50 ft.	Bowman & Connor.
Sproul's Bridge, Amaranth Township, 1913.	50 ft.	Frank Barber.

The Steel Structure of the Dominion Bank Building, Toronto

THE new head office building of the Dominion Bank of Canada, which is situated on the south-west corner of King and Yonge streets, Toronto, occupies a rectangular lot of 168 feet frontage on Yonge street and 75 feet on King street, running through to Melinda street.

The building has a basement and sub-basement, and including the mezzanine floors above the second and the ninth floors there are fifteen tiers of horizontal steel supported by forty-nine main columns, and a number of columns running through only a portion of the height. The total height of the steel frame is about 200 feet, of which 28 feet is below the sidewalk level. The total weight of the structural steel is approximately [illegible] tons. The structural design is of the typical skeleton frame type with all vertical and wind loads carried by the steel to the foundation on bed rock.

Solid rock was found at 28 to 30 feet below the sidewalk level. In some cases it was found necessary to cut into the rock to get sufficient depth to bed the column grillages. The grillages consist in general of two tiers of I-beams arranged to distribute the load uniformly over a circular concrete pier.

The greatest column load occurred on the two front columns which support the girders over the main entrance, amounting to 2,400,000 pounds. A section of this column and the arrangement of the grillage are shown in Fig. 1. Along the west well, the columns are too close to the lot line to use a circular grillage, so to avoid cantilever girder the grillages are made of a single tier of I-beams, surmounted by a cast iron base. The supporting pier is long and narrow, it being 3 ft. x 11 ft. for the heaviest wall columns on this side.

Owing to the necessity for large clear spaces in the ground floor and main banking floor some very heavy column loads are carried on girders. The heaviest of these girders has a maximum bending moment of 9,031,000 foot pounds on a span of 40 ft. c.t.c., and a maximum shear of 671,300 pounds. These were designed as twin girders with plate and angle diaphragms at the point of applied load. The material in these consisted of 2 web plates, 72 x $\frac{5}{8}$; 8 flange angles, 6 x 6 x $\frac{3}{4}$, 16 flange plates 14 x $\frac{3}{4}$, the flange plates being cut as the bending moment would permit. The weight of steel in a pair of these girders is 43,650 pounds. The girders were carried by columns of box section and the connection was made by letting the two web plates run past the faces of the column and rivetting them direct thereto. One connection required 128 $\frac{7}{8}$-in. diameter rivets. As the space between the webs of the girders did not permit of the diaphragm rivets being driven from the inside, they were connected by $\frac{7}{8}$-in. diameter turned bolts passed through the two webs and the diaphragm.

The typical floor, shown in Fig. 3, consists of ordinary framing of Bethlehem I-beams. All the col

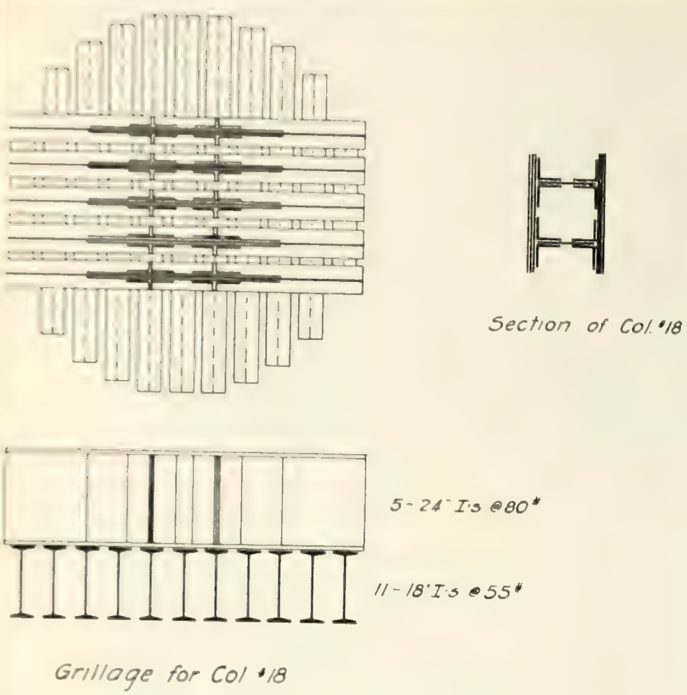


Fig. 1.—(Dominion Bank Building).

umns above the second floor are Bethlehem H-sections. In all connections of beams to columns, except the wall beams, header connections are used to give greater rigidity to the building and also to avoid projecting stiffener angles on the column flanges below the beams. No wind bracing was used above the second floor as it was considered that these stiff connections would give the necessary bracing.

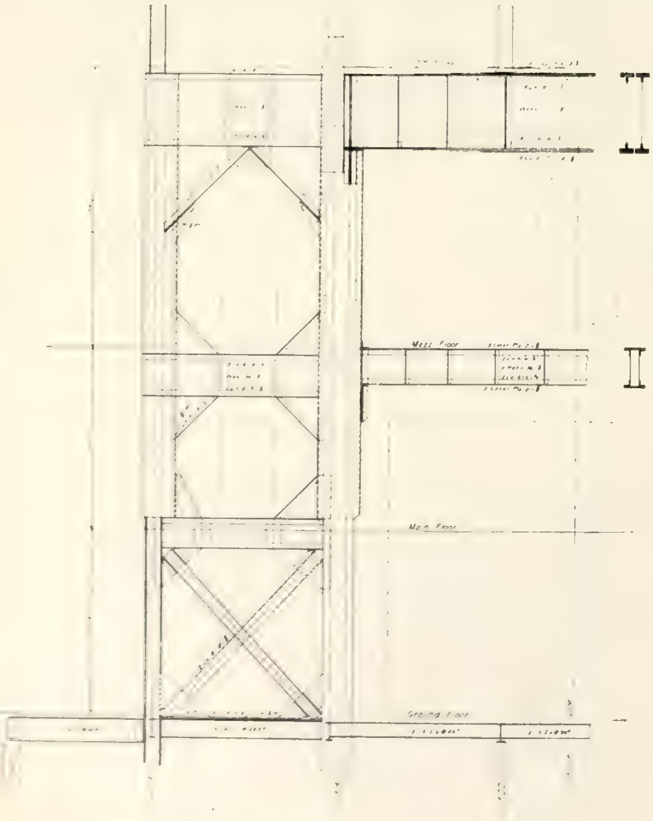


Fig. 4.—(Dominion Bank Building). Wind bracing. King Street.

The wind bracing in the King street front below the second floor is shown in Fig. 4. This shows only one-half the width of the building. In the Melinda street front the bracing consisted of horizontal plate girders at the floor levels connected to vertical girders on the column faces by deep plate knee brackets, stiffened with angles. The cut shown as Fig. 5 gives an idea of this arrangement. The end bays on the east and west faces of the building were also braced by knee brackets from the second floor to the basement.

The erection of steel was carried out by two steel guyed derricks of 15 tons capacity each, with 85-ft. masts and 75-ft. booms. Two floors were erected from one position of the derricks which were then raised by using the boom as a gin-pole to raise the mast and then raising the boom to its place by means of the mast.

The complete steel frame was erected in ten days less than three months, or at the rate of about 850 tons a month. The heaviest single piece of steel to be lifted was half the twin girder above noted, which weighed 11 tons. The heaviest column sections were nearly the same weight.

On the east side of the building under the curb it was necessary to put in a retaining wall, which, for a length of over fifty feet, has an unsupported height of twenty-eight feet. This was designed as a vertical slab supported at the sub-basement and the ground floor. It is of reinforced concrete, 26 in. thick, reinforced with vertical rods, 1 in. diameter at 4½ in. centres and with horizontal rods—to prevent shrinkage cracks—¾-in. diameter at 18-in centres. The retaining wall on the west side also acts as a bearing wall to support the four-storey brick building on the next lot.

The architects for the building are Messrs. Darling & Pearson, with Messrs. Harkness & Oxley, Toronto, as consulting engineers for the structural design. The general contractors are The Canadian Stewart Company, Limited, and the contractors for the steel work, Canadian Allis-Chalmers, Limited, Toronto. The steel was erected by The J. Hendricks Company, of New York.

Regina, Sask., is to have a new Customs House this season, the estimated cost being $200,000. It is stated that tenders will be invited at an early date.

The architects' competition in connection with the government buildings at Ottawa is closed. The judges have selected six designs and their final decision will be announced early in September. The cost of the work is estimated at five million dollars.

Classified estimates for bridge superstructures have been satisfactorily used for the payment of contractors by Mr. R. S. Uniacke, bridge engineer of the N. T. R., Canada. For a total unit price of $4.23 per 100 lb. of finished superstructure the six estimates allowed are: Delivery of steel, $1.95; fabrication, $1; delivery at site, 20 cents; assembling, 80 cents; riveting 15 cents, and painting and full completion, 13 cents. The system of reports on record makes the preparation of the estimates rapid and easy and they are found more satisfactory to all concerned than the custom of allowing 20 per cent. when erection is commenced and the balance on completion.

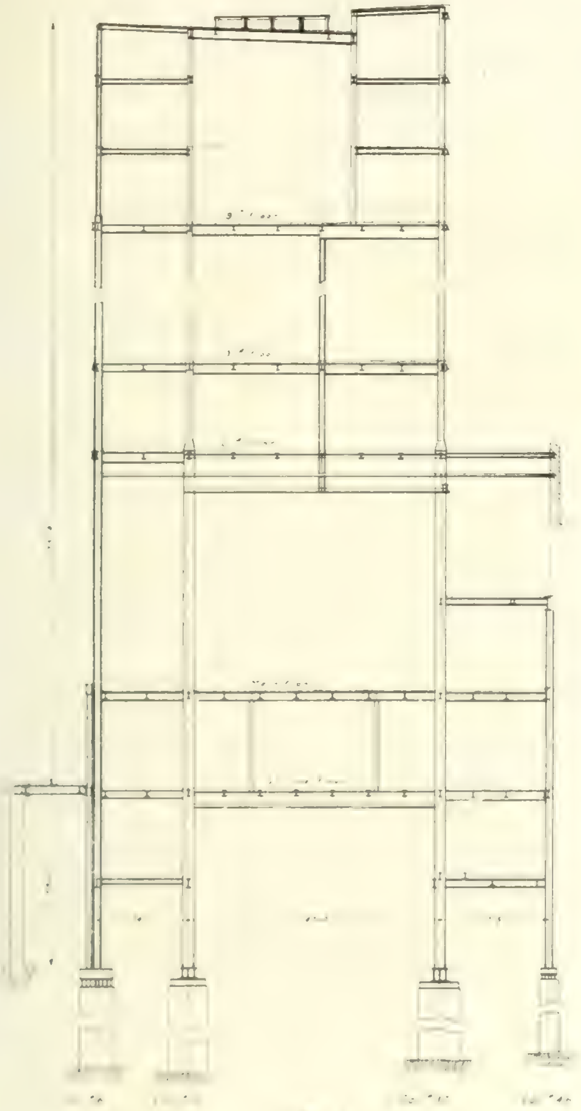


Fig. 2

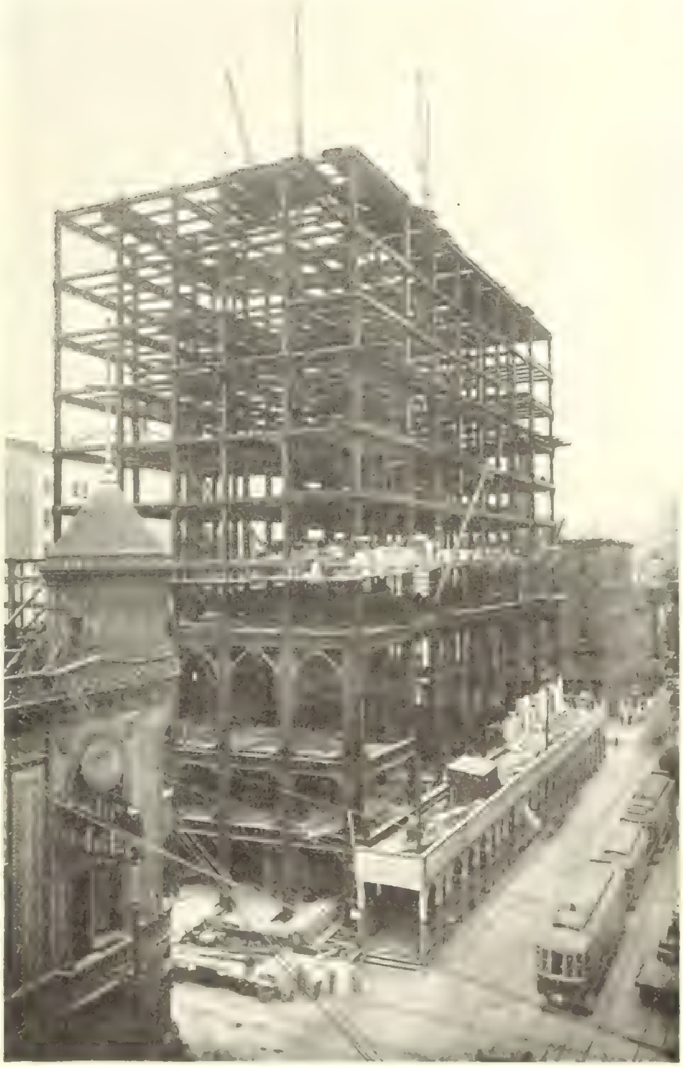


Fig. 3

Steel Structure of the Dominion Bank Building, Toronto

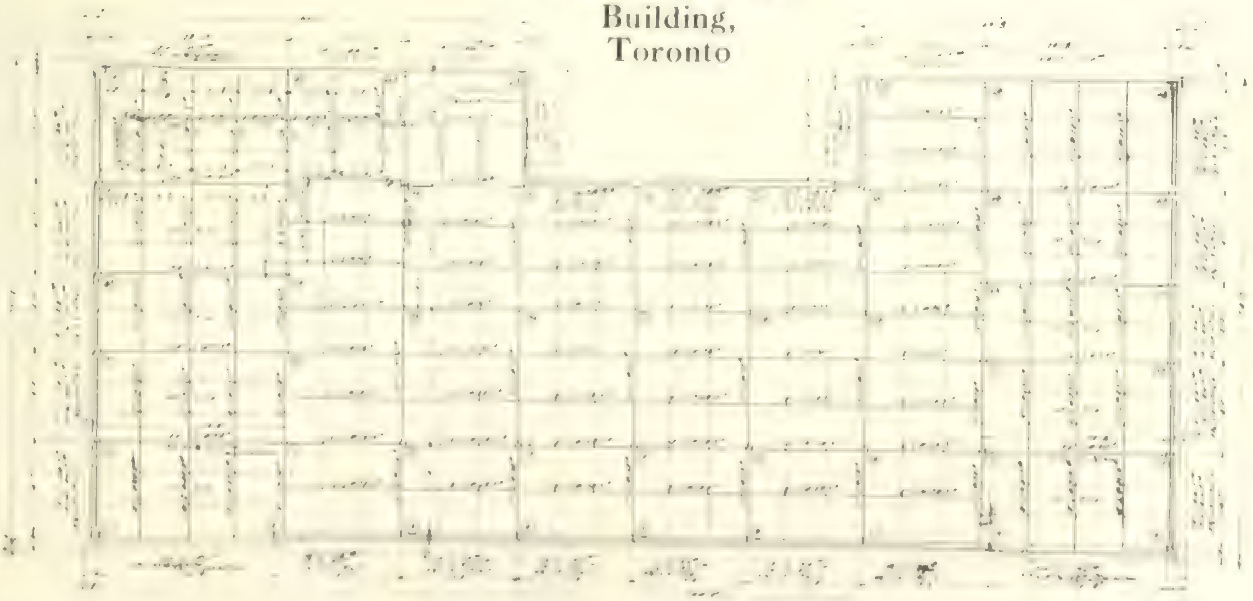


Fig. 4—Sixth, seventh and eighth floor framing plan.

The Present Status of the Marble Industry in Canada*

By Dr. W. A. Parks, University of Toronto

MARBLE is essentially a decorative stone, in no wise necessary for purposes of construction or indispensable for the life and comfort of a community. Even when used for exterior walls, marble is not recommended on account of either its strength or durability, but solely on account of its superior appearance, or in other words, its decorative value. The use of such material is obviously controlled by two factors—wealth and artistic taste, but the part played by each of these factors is more difficult to determine, for wealth is sometimes ostentatious and artistic taste is too often made the scapegoat of style. Assuming, however, that wealth has been kept in its proper place as the servant of culture, it is interesting to ascertain if the consumption of marble is in accord with the increasing prosperity of Canada. A numerical expression representing the prosperity of a country is difficult to obtain, but subject to criticism, we may regard the total imports and exports as roughly indicative of prosperity, or better, in a country like Canada, the exports alone. The following table shows the imports and exports, the exports alone, the consumption of marble, and the ratio of marble consumption to the total trade and to the exports.

Year (Fiscal)	Impor and Exports	Exports	Marble Consumption*	Ratio of Marble Consumption to total trade	Ratio of Marble Consumption to export
1881	$203,621,663	$98,290,823	$ 85,977	.00042	.00087
1891	218,384,934	98,417,296	109,413	.00041	.0011
1901	386.903,157	196,487,632	96,159	.00025	.00049
1909	571.268,769	261,512,159	359,369	.00063	.0014
1910	693,211,221	301,358,529	343,577	.0005	.0011
1911	769,443,905	297,196,365	470,211	.0006	.0015
1912	874,637,794	315,317,250	661,499	.00076	.0021
1913	1,085,264,449	393,232,057	761,302	.0007	.0019

*The slight exports are neglected. The imports are for the fiscal year and the production for the calendar year.

An inspection of this table shows, in a general way, that the consumption of marble is more than holding its own with the increase of wealth. This conclusion is satisfactory, but there is little reason for congratulation in the figures representing the domestic production as compared with the importation of marble during the same period of time.

Year (Calendar)	Canadian Production	Imports	Ratio of Production to Imports
1881	nil	$ 85,977	.000
1891	$ 1,742	107,661	.016
1901	nil	96,159	.000
1908	125,000	287,587	.43
1909	158,441	182,147	.87
1910	158,779	267,215	.59
1911	162,783	384,252	.42
1912	260,764	475,976	.54
1913	250,373	577,082	.43

Prior to 1908 the production of marble in Canada was insignificant; the industry as a commercial factor dates from the opening of the quarries at Phillipsburg, Quebec, in that year. The production has never equalled the imports and the ratio as shown in the last column above is not encouraging. This unsatisfactory showing has resulted notwithstanding a reasonable protection as indicated in the table of tariffs below:

	British preferential % ad valorum	Intermediate % ad valorum	General % ad valorum
Marble, rough, not hammered or chiselled	10	12½	15
Marble, sawn or sand rubbed	15	17½	20
Marble, manufactures of, not otherwise specified	30	32½	35

By the tariff revision which came into effect on April 7th, 1914, the intermediate duty on sawn or sand rubbed marble was raised to 20 per cent.

An industry only six years old is much too young to bear a close scrutiny and the marble industry is particularly sensitive as it is subject to the pre-conceived ideas of builders and frequently has to combat the prejudices of architects. In other words, the market value of a marble, however beautiful, is not intrinsic as in the case of gold or copper, but is controlled by prevailing styles and other factors too numerous to mention. On the other hand, a desirable stone must eventually win its way into popular favor if it can be placed on the market at a reasonable price and if the all-important matter of advertisement is not neglected. In Canada to-day our own marbles are not as well known as imported varieties and, until the public is thoroughly educated in the matter, there is no hope that the domestic article will make serious headway against imported stones. It must be remembered, however, that under no circumstances can Canadian marble entirely replace foreign varieties, for the use of decorative stone is art, not engineering, and can therefore never be entirely subject to the ordinary laws of supply and demand.

Our figures show that Canadian marbles during the six years of production have not replaced foreign stone to the extent that might be desired, but the explanation does not lie entirely in the considerations given above; it lies rather in the inability of the present producers to fill a large order in stone sufficiently uniform to meet the requirements of architects. Again, and it may as well be freely admitted, many of the Canadian marbles are too hard to be chiselled with facility and are consequently rejected by monument makers in favor of softer stone from abroad. This objection applies with less force to architectural marble, a large proportion of which is prepared without recourse to hand carving. A third cause for the lack of the desired increase in production is the gross misapplication of certain stones, whereby an undeserved bad name is acquired. Without enlarging on this subject it may be stated that no polished marble, domestic or foreign, is a suitable material to expose to the winter climate of Canada and that delicately variegated stones are not adapted to the manufacture of unsupported counters or table tops. A most severe condemnation of a certain Canadian marble came from a workman with shellac pot in hand busy in the mending of a slab of foreign marble. If we are content to back foreign marbles with slate, to bolster them with plaster, and to coax them to hold together with shellac, why should we ignore the doctor and send for the undertaker in the case of a Canadian marble tainted with the same disease?

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*[illegible] permission of the Director of the Mines Branch, Department of Mines, Canada.

The first and most important question in connection with the marble industry is to determine if marketable stone occurs in the country; the first stage of this inquiry is the locating of possible sources of supply. In eastern Canada marble occurs under three conditions which must be considered in a review of the subject:—first, in the great crystalline complex; second, in less disturbed, but marmorized limestones of later age; third, in narrow bands associated with altered rocks of various ages.

Marbles of the Ancient Crystalline Complex

The great area of crystalline rocks, which forms the major portion of northern Ontario and Quebec, contains numerous bands of marble which stretch in a northeast and southwest direction and occur from the vicinity of Renfrew to beyond Three Rivers. These marbles are of very ancient origin and are associated with gneisses and other hard crystalline rocks. Under similar conditions occur the marbles of South Stukely, Quebec and those of the island of Cape Breton. The normal stone of these deposits is a coarse grained white or blue-banded type, which is frequently charged with quartz, interbanded with impurities or rendered undesirable by reason of indifferent color. In many places, however, the stone is of desirable quality for building purposes, and in others it possesses the requisite grain and beauty to lift it into the class of decorative marbles. There can be no question that highly desirable marbles of this class occur; but it must be remembered that a wide difference exists between a pretty specimen and a marble quarry. Conditions must be met which are too often overlooked by enthusiastic prospectors. In the first place, the stone must be of reasonable uniformity and it must occur in sufficient quantity to justify quarrying operations. Secondly, the formation must not be so shattered as to prevent the extraction of quarry blocks without undue waste; for ordinary decorative marbles, the formation should permit the extraction of blocks 4 ft. x 4 ft. x 6 ft.

The marbles of this class in the Maritime Provinces have suffered severely from fracturing, so much so, that all attempts to work them have met with failure although some beautiful varieties occur near St. John, in New Brunswick and at Marble Mountain, River George, Eskasoni, Whycocomagh and other points in Cape Breton.

The marbles of the crystalline areas in Ontario and Quebec are much less shattered than those of the Maritime Provinces and blocks of the desired size can doubtless be obtained at many places. The following table presents a rough classification of these stones and indicates the more common localities of occurrence.

I. White Marbles—
  Haleys, Renfrew County, Ont.
  Portage du Fort, Pontiac County, Quebec.
  Township of Barrie, Frontenac County, Ont.
  Township of Dungannon, etc., Hastings County, Ont.

II. Variegated Marbles—
  (a) Blue-clouded or banded marbles.
    i—Fine grained and delicate.
      Calabogie, Renfrew County, Ont.
      South Stukely, Quebec.
    ii—Coarse banded or clouded, light.
      Renfrew, Ont.
      Fitzroy Harbour, Ont.
      Portage du Fort, Quebec.
      St. Saveur, Quebec.
    iii—Coarse clouded or banded, dark.
      Arnprior, Ont.
      South Stukely, Quebec.
    iv—Blue predominating.
      Actinolite, Hastings County, Ont.
      Lanark Village, Ont.
      Portage du Fort, Quebec.
      South Stukely, Quebec.
    v—Very dark (black marble).
      Madoc, Ont.
  (b) Coloured Marbles:
      Township of Dungannon, etc., Ontario.
      South Stukely, Quebec.
      Ste. Thecle, Quebec.
      Garden River, Ontario.

III Serpentine Marbles:
    Township of Darling, Lanark County, Ont.
    Township of Grenville, Argenteuil County, Que.
    Township of Melbourne, Richmond Co., Que.

The White Marbles

The marbles of Portage du Fort and Haleys are coarse in grain but uniform in color and structure, they occur in large quantity and under conditions which should render quarrying easy. These stones will probably find their chief application as high grade building material. Two companies are at present en-

Channelling machines at Dominion Marble Company's quarry
South Stukely, Que

Disposition of beds in quarry of M[illegible]
Phillipsburg, Q

engaged in work preparatory to placing the stone on the market.

The marble of Barrie is beautifully white and fine in grain, but it is marred by large included crystals of foreign minerals and is situated at too great a distance from a railway.

The Dungannon white marbles are of medium to fine grain and show slight shades of different colors. Many of these stones look very promising, but their commercial possibilities are not yet thoroughly established.

The Blue-banded Marbles

Nearly all the blue and white-banded marbles are of coarse or medium grain and are well adapted to building; they may, of course, be used for decorative purposes, but, as a rule, the coarse grain is not offset by any particular beauty. The fine grained and delicate stone from Calabogie, and some of the varieties from South Stukely, are exceptions. The very dark marble of Madoc may eventually prove valuable for certain purposes.

Pontiac Lime Company's plant at Portage du Fort, Que.

The Colored Marbles

Highly ornamental variegated marbles, in varieties too numerous to mention, are quarried by the Dominion Marble Company at South Stukely, Que., and by the Ontario Marble Company at Bancroft, Ontario. A third firm, the Canadian Marble Company, has acquired properties near Bancroft and will shortly enter the field. Up to the present a greater measure of success has attended the quarrying of this type of stone than has resulted in the case of the other marbles of this class. Many of these colored marbles are in every way desirable and meet all the demands of beauty, durability, size and susceptibility of polish. The one great difficulty, a difficulty inherent in variegated stones, is that of too much variation. These colored stones run in bands of limited width with a highly inclined or vertical dip. The bands vary within themselves and, moreover, they are not strictly bands, but lenses, which may fail or alter in character with depth. Now, in many cases, an extensive quarry cannot be worked on a single band and in consequence several bands must be quarried at once. It is apparent, therefore, that a stated variety is raised in small quantity only by the removal of each successive floor. The less desirable bands or those less in demand must be raised also and if this product is not marketed, or if the company is unable to carry a large reserve stock, operations are of necessity suspended. Experience seems to show that marble quarrying can be successfully carried on only by means of large plants and modern machinery. A second necessity in the case of these variegated stones is the accumulation of stocks of sorted material. Nothing has done more to shake the confidence of architects in our colored marbles than the difficulty experienced in having orders filled, in a given variety, within a reasonable time. The solution of this difficulty seems to lie along many lines. The following suggestions are made in the hope that operators may find in them something of advantage.

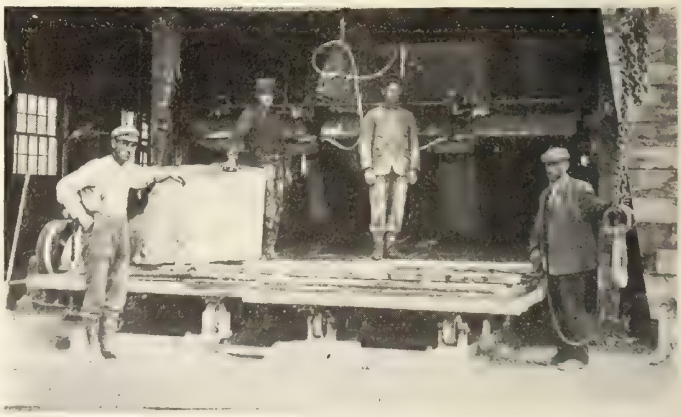
1. Companies should not advertise too many varieties, when they must themselves know of their inability to supply them in quantity.

2. A big local quarry with a fixed plant labors under the necessity of quarrying a large amount of material of less desirable character in order to procure a small amount of a variety in demand. While operations on a large scale are necessary for successful competition, it may be that the large quarry is not the best adapted to the exploitation of these variegated (and variable) stones. A more flexible plant with portable units, capable of following the desirable bands along the strike, might perhaps meet the conditions in a more satisfactory manner.

3. The question naturally arises "Is the total consumption of colored marbles in Canada sufficient to warrant the installation of a plant large enough to make possible the successful competition with foreign marbles?" While I am unable to answer this question I am, nevertheless, certain that many of our marbles are sufficiently attractive to win their way in the foreign market. The United States duty on rough blocks is 50 cents per cubic foot. This is not an impossible barrier against material which could be marketed in New York at from $5 per foot up.

The Serpentine Marbles

Beautiful serpentine marbles in green and white, lavender and green, and in yellow and white have been quarried by the North Lanark Marble Company, in the Township of Darling. This company is now awaiting the completion of a railway before resuming operations, which have been suspended for some time.



Diamond saw at Pontiac Marble & Lime Company's mill, Portage du Fort, Que.

The serpentine marbles of Grenville and those of Melbourne and Cleveland in Quebec have never reached economic importance.

Marbles of the Sedimentary Series

Limestone, formed by sedimentation in the ocean, is one of the commonest rocks of Ontario and Quebec. In some places these limestones have been converted into marble by the action of heat and other agencies. The more important localities at which marbles of this type occur are at Phillipsburg, Dudswell and Port Daniel in the province of Quebec. The two latter localities are of no present economic importance, but at Phillipsburg, the Missisquoi-Lautz Corporation is operating the largest quarrying plant in Canada. The marble belt is very extensive and is composed of beds of limited thickness disposed at a slight angle with the horizontal. These marbles consist mostly of grey and green mottled varieties, with some more highly colored examples. An expensive and efficient quarrying plant is provided which controls the site of the present quarry. As the beds vary in character and are nearly horizontal in position, it is apparent that quarrying operations must soon remove the whole of a given variety (bed) throughout the area of the quarry. Therefore, the same difficulty is encountered which was referred to in the case of the marbles of the first class, i.e., the continual production of a stated variety is not easy under the conditions prevailing in the quarry. It would appear, however, that an abundance of the more popular stones is available; the corporation will doubtless devise methods of quarrying which will result in a continual output of the varieties in demand.

Marbles of the Third Type

Associated with the stratified sandstone, limestones, shales and other rocks in the metamorphic regions of Quebec and the Maritime Provinces, are narrow bands of brilliantly colored and variegated marbles of indisputable beauty. Much has been said as to the possibilities of these deposits, but it must be admitted that any attempts at quarrying have not met with success. The reason seems to lie in the shattered condition of the outcrops and the limited amount of desirable material exposed. The more important localities at which stone of this type occurs are near St. Joseph on the Chaudiere River, above Richmond on the St. Francis and in Orford Mountain in Quebec, and on the St. John River above Hampstead in New Brunswick.

In British Columbia

Throughout the above remarks no mention has been made of British Columbia, but that province has contributed somewhat to the total production of marble in Canada. Marble has been worked by the Canadian Marble and Granite Company, near Lardo. The stone is rather coarse in grain and presents shades from white to dark blue. The formation is very solid and blocks of any desired size can easily be obtained. The Nootka Marble Quarries Company has obtained a blue-grey marble with whitish markings from its quarries on Nootka Sound. Marble quarrying on the coast does not seem to have met with great encouragement, as the production in 1909 was $25,000, in 1910 it was $5,679; it fell to $1,600 in 1911 and to nothing in 1912.

The great Ashokan aqueduct to supply the city of New York, now in course of construction, is the only modern hydraulic enterprise intended mainly for domestic and industrial use, that compares fairly with the Los Angeles aqueduct. The New York aqueduct crosses the Hudson over a thousand feet beneath the river bed, and it will furnish the metropolis with 500,000,000 American gallons daily at a cost, including its various reservoirs, of, roughly, $170,000,000. The Los Angeles aqueduct has not much more than half the capacity of the Ashokan, but it is about twice as long, passes through an incomparably rougher country, and its cost, when completed, will, it is said, be less than one-fifth that of the great New York enterprise.

Miscellanea

Nitrogen over 1 sq. mile of the surface of the earth is estimated to be sufficient to supply the whole world with fertilizer for fifty years at the present rate of consumption. To produce nitrate fertilizer from the air to an amount equal to that now used by the civilized world would require an investment of $860,000,000.

Mrs. Victor Garnish, who was for twenty years a licensed engineer in Minnesota, applied last month to take out a license in Regina to run her husband's traction engine, but the Saskatchewan law allows male engineers only. She says there are many women in the province who would become engineers if they could.

Foundation work has commenced on the Arts Building at Edmonton, Alta., which is to be erected for the University of Alberta at a cost of $500,000. The contractors are Messrs. Geo. A. Fuller & Company, Limited, Winnipeg. The structure will be four storeys high, 60 ft. by 375 ft. in dimensions, of brick and stone construction.

The durability of reinforced concrete poles was amply demonstrated during the past winter in the experience of one of the railroads, which has been making an experimental test of these poles. During severe storms the poles of this company were severely taxed and in many cases the overloaded wires bore their supports to the ground, but in no instance did a concrete pole fall, although in several cases the weight was so great as to break the wooden arms carrying the wires

A case of interest to contractors generally was heard before Mr. Justice Panneton in Montreal on May 1, when The Canadian Spool & Cotton Company sued the well-known firm of building contractors, Messrs. Peter Lyall & Sons, and Messrs. Brown & Vallance, architects, the cause of action being "dry rot" which was alleged to have attacked and considerably depreciated a building erected for the plaintiff by Messrs Lyall under the direction of the architects. The primary cause of the damage was alleged to have been the employment by the contractors of a quality of wood other than and inferior to that called for in the architects' specifications, according to which latter the contractors undertook to supply "all timber, Georgia pine, long leaf, straight grain, free from knots." That they failed to do so, except in small quantities, was admitted, the reason given being that it was found impossible to obtain the required quantities otherwise than at prohibitive prices as the lumber would have to be picked at different mills. It was contended on behalf of the contractors that a good merchantable grade of wood was used. The dry rot was discovered only after the plaintiff had been in full possession of the building for nearly a year. The wood used did not appear to have the same resisting ability to the dry rot germs as that required in the specifications, with the result that the plaintiff was forced to renew and replace with steel the beams throughout the structure, the expense incurred in this operation totalling about $91,000. His Lordship gave judgment for the plaintiff for $71,120. It is intimated that the case will be appealed

Waterproofing—Its Early History and the Development of Modern Methods

By W. H. Evans[*]

WATERPROOFING is divided into two classes —membrane waterproofing and integral waterproofing. The early history of waterproofing is clouded in mystery, there being little or no literature on the subject.

The first successful waterproofers were the Romans, and they were also the first successful manufacturers of cement. Waterproofing consisted primarily in building foundation walls so thick that it was difficult for water to penetrate them. At the time Caesar invaded Gaul, about 2,000 years ago, the Romans found a mineral (now known as cerusite) from which they obtained lead. The metal was too soft, however, for technical use, but they soon discovered on rolling it into thin sheets, that it corroded only on the surface.

Sheet lead has been found the most suitable material for conveying water, for the reason that the white scum which forms on the surface does not go any further. This scum is an oxide which seems to protect the lead underneath it. Iron pipes which are used for conveying water rust out completely in time. We are thus indebted to the Romans for the real introduction of waterproofing foundation walls.

During feudal times the method of protection practised by the ancients was to build castles surrounded by moats. These moats were huge ditches filled with water spanned by a drawbridge. When the enemy approached the castle the bridge was drawn up, thus isolating the inhabitants and making them invulnerable. The ancient Britains and Normans soon found that water penetrated into the cellars or dungeons of the castles. When these dungeons were used for prison purposes, they cared not whether they were wet or dry, but it was found later on that the seepage undermined the foundations, which necessitated waterproofing them. In some cases this was accompanied by the use of sheet lead, in others with huge stones laid up in cement, but the latter did not prove effective.

The Membrane Method

The membrane method of waterproofing has been used, in one form or another, for a considerable period, but the use of concrete and stucco in modern construction has led to a realization that the Integral Method of waterproofing is the proper one to adopt. Waterproofing therefore became divided into two classes as stated, membrane waterproofing and integral waterproofing.

Membrane waterproofing is of two classes, known as hot and cold applications. The hot application being the better method of the two, originally was only done with one or two coats of a waterproofing compound—either coal tar or asphalt—but was found to be inefficient in some respects. In order to strengthen the waterproofing and overcome its defects, the addition of waterproofing compound and one layer of felt and another coating of waterproofing compound was made. The specifications gradually grew until at the present time nothing less than three ply of waterproofing is considered. This is gradually increased to as many as seven or eight ply, depending entirely upon the water pressure and the depth of the structure.

The reason why the felt was added was to strengthen the waterproofing compound, as it responded to the temperature changes very quickly. In cold weather the waterproofing compound hardened to such an extent that it became brittle, and disintegration of the compound under such a condition was rapid. In warm weather when the temperature was at its highest it did not set up hard enough, consequently it was very easily scraped in places by the back fill, particularly if the latter was coarse and contained refuse from the building, thereby causing considerable trouble through leakage. To overcome this, therefore, the addition of a felt was deemed advisable.

In the other method of construction of foundation walls, either of stone or brick, the general custom has been first to lay up a course of four inches of brickwork about five feet high, then apply the waterproofing as prescribed in the specifications, and immediately back up by brick or stone work of such thickness as the specifications call for.

Architects early recognized that a straight line of waterproofing from the footing to the water table meant a weakening of the structure. It threw the entire weight of the building upon the inner wall, because the line of waterproofing did not allow the outer veneer to combine the inner wall sufficiently strong to make it carry its proportion of the weight of the building. Consequently the specifications were changed so that the waterproofing was run up five or six feet perhaps on a straight line. It would then carry it into the wall about eight inches at right angles and along the outside of the wall for about eight inches, back again to the original line of waterproofing. Waterproofing contractors soon pointed out to architects and engineers that every time a turn or angle was made it increased the danger of a leak; but as nothing better was suggested it was generally accepted as the best solution of the problem. Their attention was also called to dampness in the walls due to various causes, mainly to the brick or stone being first wetted down before being put in the wall and to capillary attraction, which made it almost impossible to get a perfect bond between the waterproofing and the wall. The contractors also found considerable difficulty in getting a perfect bond between the waterproofing and the wall, because of difference in temperature, as it was necessary to apply the waterproofing compound at a temperature varying from 200 to 250 degrees. The temperature on the walls at no time was higher than 90 to 100 degrees. The difference in temperature between the wall and the material invariably had a tendency to chill the waterproofing compound at the point of contact.

These drawbacks having been recognized, architects, contractors, and engineers began looking for a different method, and finally hit upon the idea of a cold application which could be put on the surface at a temperature where both materials and surface were about equal. Several manufacturers of waterproofing compounds next produced materials which could be applied cold and which possessed sufficient tackiness to make the felt adhere. The majority of these materials being composed of waterproofing compounds with a volatile solvent, the rapid evaporation of which caused the compounds to harden quickly and thereby lose some of its adhesiveness, it was found next to impossible to carry up two layers of the felt. In order to overcome this burlap was gradually introduced in place of the saturated felt. The number of layers was reduced to an application of waterproofing compound, one layer of burlap and a finish coat of waterproofing compound.

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[*] Waterproofing Engineer, Dartnell Limited, Montreal

In the early stages of waterproofing with the ground adoption of a combination of compounds and felts, the danger from abrasion and punctures due to back fill was recognized. Where a coating of that kind was specified to be carried up on the exterior of the wall, which was sometimes done in order to maintain the full strength of the foundation wall, a safety coat of cement mortar was specified to be applied immediately on top of the waterproofing compound. This was to act as a safeguard against abrasion by the back fill.

With the introduction of concrete in foundation construction, the straight smooth line from the footings to the water table presented some difficult problems, among which was the trouble in getting proper adhesion for a waterproofing, as concrete construction being laid up in forms made it impossible to key it into the wall. A substitute for this was looked for, with the result that manufacturers catering to that class of business gradually produced materials which were structure waterproof. This was introduced as the "Integral Process." It seemed to be the ideal thing and was generally recognized as a proper solution of all previous waterproofing troubles.

Integral Waterproofing

Integral waterproofing is based upon four theories, each theory being advanced by the manufacturer of a specific compound, and I will classify them as A, B, C and D.

In class A theory, the manufacturer claims that by the introduction of two per cent. insoluble matter into the body of concrete evenly distributed throughout the mass by a mechanical operation, and then cast in form, a physical force develops which drives the insoluble matter during the process of crystalization of the cement into the voids, and in that way waterproofs the concrete.

The second theory is advanced by the manufacturer in class B. His view is that in order to waterproof concrete properly it is necessary to lubricate, thus avoiding the voids. His idea of lubricating the concrete mass is to introduce into the concrete an emulsion. He believes that the action resulting from the mix of cement, water and emulsion will sufficiently lubricate the mass so as to bring about a close, compact body of concrete.

The manufacturer who advances class C theory claims that cements are not wholly colloidal, and that the coarser and non-colloidal particles of cement must be made colloidal. He does this by the introduction of his material, and by producing this condition preserves the physical construction of cement in its entirety, and brings about 100 per cent. of efficiency in the action of the cement in concrete construction. Doubtless the manufacturer of class C theory understands fully one of the drawbacks in concrete construction. Therefore he claims to have produced something which fills one of the defects in the construction of cement by the introduction of his material. The fact remains, however, that the so-called non-colloidal particles of cement are mostly of a clinker nature, and if such action is produced in the clinker it is my belief that an ultimate reaction is bound to result. If a reaction does take place it should receive the consideration of the architect and engineer who specifies such a material.

The manufacturer in class D theory agrees with the manufacturer in class A that voids in concrete will occur. He also recognizes the necessity for lubricating the mass as claimed by the manufacturer in class B. At the same time he recognizes the importance of the theory advanced by the manufacturer of class C that the physical construction of cement in its entirety must be put into the concrete mass. He has therefore manufactured an article which he claims to be waterproof concrete. His theory is that while recognizing that the cement is not 100 per cent. colloidal, it is necessary to lubricate it. He also feels it is impossible to fill the voids in concrete by the theory advanced in class A. The material which he adds to the concrete is a colloid of the same nature as cement but of a much higher percentage, claiming that by reason of the introduction of the material that he manufactures, he carries into the cement the full 100 per cent. of efficiency, and by introducing an additional colloid increases the cohesion of the cement, thereby lubricating it sufficiently to produce a close ground body made of cement, sand, gravel or stone.

The writer believes it to be possible to make concrete absolutely waterproof without introducing any waterproofing compound. At the same time he is convinced that conditions on the field make it impossible at all times to do this. While it has been demonstrated in laboratories that a concrete made even of a 1-3-5 mix can be made absolutely waterproof without the introduction of any waterproofing compound, such results have not been achieved in field work. The introduction of a material that will assist materially in producing that condition is therefore absolutely necessary. The importance of waterproofing concrete becomes more apparent on account of the expansion and contraction of concrete due to the absorption and evaporation of moisture.

Having gone over the question of waterproofing of the different types, having classified it in its different theories, the reader will agree that, having transplanted concrete from a substructure proposition to a superstructure proposition, it becomes necessary to take precautions to avoid extreme expansions and contractions. It is the duty of architects, engineers and cement users to select for themselves that which they consider will best answer their purpose.

A new station estimated to cost $250,000 is to be erected at Calgary, Alta., by the C. N. R. Plans have been completed and operations are to commence in June.

A new customs house estimated to cost $400,000 is to be erected at Ottawa this season for the Dominion Government. The foundation work is now in progress, the operations being carried on by the Foundation Company, Limited, of Montreal.

The Forthcoming International Road Congress at Montreal

SOME 30,000 invitations to the first Canadian and International Good Roads Congress, to be held in the Arena, Montreal, May 18 to 23, have been sent out, and the replies indicate that representatives from all parts of the Dominion will be present. Many of the speakers are recognized as authorities on the subjects to be discussed, which will cover the entire field of road construction, maintenance, and appliances. Those attending will have the benefit of the experience of men who have a practical as well as a theoretical knowledge, and who have tried out many systems and methods. Highway legislation is one of the questions which will be discussed, while technical training in road building, not only on the American Continent but in Europe, will be another subject which will come under review.

Canada is spending, and will continue to spend for many years, very large sums on new roads and on improving existing highways, and it is essential that we should have the means of securing the best technical education if the expenditure is to give the most economical results. There is also a pressing need for educating the inhabitants of the rural districts along the lines of the good roads movement—its value from the point of view of affording easy communication between various localities and also from the standpoint of productive expenditure. Men in the agricultural sections in particular are reluctant to expend money on roads unless direct benefits can be shown, and the movement is doing good work in pointing out the immediate and future good results which accrue from a liberal expenditure on highway improvements. In some instances where the construction of roads will materially aid communities there is a reluctance to spend money; as an example, the opposition of some municipalities to the Roads Bill of the Quebec Government may be cited. Here the Government offered the most liberal terms, with a very low rate of interest, in order to induce municipalities to put in order their roads, but notwithstanding, exceptions were taken to the provisions of the Bill.

Mr. U. H. Dandurand, Chairman of the Congress.

It may be broadly stated that the most progressive councils are those with the best kept roads under their jurisdiction. It does not follow that the most lavish expenditure gives the most economical results, and it is one of the main objects of the Congress to indicate how money can be spent to build the best and most permanent roads. The papers to be read are of so varied a nature that the needs of practically every locality will be dealt with, and engineers of municipalities will be able to secure data which will prove of value in the laying out of roads.

Apart from the papers which will be contributed, the exhibition of road material and machinery should prove of interest. It will include materials of practically every well known type, while the machinery will embrace appliances of every kind used in the construction and maintenance of highways. The manufacturers will have, during the evenings, opportunities of explaining by means of moving pictures, the uses and advantages of their products. The Ontario Government will loan models of roadways of various countries, some of the very earliest types. These models will illustrate how roads are built up, and will indicate the progress which has been made during recent years.

The speakers will include—Sir Francois Langlier, Lieut.-Governor of the Province of Quebec, who with Sir Lomer Gouin, Premier of Quebec, will open the Congress; Honourable G. Tessier, Minister of Roads, Province of Quebec; W. A. McLean, M. Can. Soc. C. E., Chief Engineer of Highways, Department of Public Works, Province of Ontario, and President, the American Road Builders' Association; Paul D. Sargent, Chief Engineer, State Highway Commission, Augusta, Maine; Dr. E. Merrill Desaulniers, M.L.A., Chambly County, Que.; E. A. James, B.A.Sc., Consulting Engineer and Engineer Board of Highway Commissioners, York County, Toronto, Ont.; J. W. Levesque, M.L.A., Laval County, Que.; Walter W. Crosby, C.E., Consulting Engineer, State Highway Commission, Baltimore, Maryland; Lt.-Col. W. N. Ponton, President, the Ontario Associated Boards of Trade, Belleville, Ont.; O. M. Hezzlewood, President of the Canadian Automobile Federation; Jean de Pulligny, M.A.S., C.E., Chief Engineer of the French Government's Civil Engineering Service; H. W. Pillow, Chairman Good Roads Committee, Canadian Automobile Federation, and President, Automobile Club of Canada, Montreal, Que.; William H. Connell, Chief of Bureau, Department of Public Works, Philadelphia, Pa.; A. T. Laing, Professor, Faculty of Applied Science and Engineering, University of Toronto, Ont.; Arthur H. Blanchard, Professor of Highway Engineering, Columbia University, New York City; T. Hugh Boorman, C.E., Treasurer, American Society of Engineering Contractors, New York City; R. A. Meeker, Engineer, Dept. of Public Roads, State of New Jersey, Trenton, N.J.; C. L. Shorey, Chairman, Road Committee, Town of Beaconsfield, Que.

The officers of the Congress are U. H. Dandurand, Chairman; Horace Joseph, vice-chairman; and Geo. A. McNamee, general secretary. Executive committee: U. H. Dandurand, O. M. Hezzlewood, H. W. Pillows. Reception Committee: H. H. Learmont, Chairman; W. A. McLean, Dr. E. M. Desaulniers, M.L.A., J. W. Levesque, M.L.A., Frank G. Carrel, L. C. Rivard, Honore Mercier, M.L.A., C. P. Beaubien, L. E. Geoffrion, Hon. Geo. R. Smith, F. H. Anson, A. Berthiaume. Entertainment committee: J. A. Davis, Chairman; J. Davidson, A. L. Caron, H. W. Pillow, Controller Duncan McDonald. Publicity Committee: Eug. Tarte, Chairman; J. Vernon McKenzie, W. G. Robertson. Exhibition Committee: E. W. Sayer, Chairman; W. H. Leach, Geo. A. McNamee.

Constructional News

The Quebec Highway Commissioners have awarded to Messrs. O'Brien & Doheny the contract for a stretch of road [illegible] miles long. The price was $224,000.

The County Council of Oxford, Ont., has decided to expend $320,000 on a system of county roads with the proviso that only $60,000 shall be spent in one year.

The Welland County Council extends an invitation for tenders until May 23 for thirty-four miles of macadam road construction, the estimated cost of which is $153,000.

At Saskatoon, building operations are to commence shortly on a four-storey apartment block estimated to cost $150,000. The prospective owner is Anthony Le Jeune, of Saskatoon.

The sewage disposal plant at Morley Avenue, Toronto, which involved an expenditure of $800,000, is to be replaced by the Imhoff tank system at an estimated cost of two and a half million dollars.

The plans for the new Union Station at Toronto have been finally approved and work on the new structure will be started in three months, the period allowed for receiving tenders and awarding contracts.

Swift Current, Sask., is to have a courthouse at an estimated cost of $125,000. Tenders for the erection of the building are now being received by the Department of Public Works of the Provincial Government.

Replying to a question by Mr. Lemieux in the House of Commons a few days ago, as to whether tenders had been asked from Canadian firms for the construction of new equipment recently secured in Great Britain by the Quebec Harbor Commission, Hon. J. D. Hazen stated that tenders had been invited from several Canadian firms, all of which were higher than the accepted tender.

Plans which have been approved this year by the C. N. R. management provide for the construction of yard trackage to store and manipulate 10,000 freight cars and 1,000 passenger coaches. Trackage, round-houses, shops, tool-working mills, turning and moulding shops are provided for in the scheme which the company are planning for the extensions of their terminal facilities at Port Mann, B.C.

The St. John Board of Trade have recently been investigating the possibilities of opening up trade with South America, particularly the Argentine. Trade Commissioner Pousette, who recently interviewed the Board of Trade on the subject, expressed the opinion that trade might be developed satisfactorily along the lines of agricultural implements, nails, automobiles, railway rolling stock, edge tools, stoves, furniture, etc.

Building developments throughout New Brunswick are very active at present, particularly at St. John where several large buildings are in progress. The Canadian Pacific Railway Company has already entered into contracts for the rebuilding of the Algonquin Hotel which was burned down recently at St. Andrews. The new building, which will be completed next year, promises to be one of the finest yet constructed for the Company.

The Dominion Railway Board has reserved judgment on the question of apportioning the cost of the North Toronto grade separation and viaduct. The contention of the C. P. R. is that the city should contribute half the cost of the work, while the city's argument is that the entire cost should be borne by the railways, the city's streets having the prior right-of-way. The proportion of the cost in which the city is asked to share is $1,500,000.

The building permits issued in Montreal during April totalled 527 in number and in value $2,205,970, against 450 permits of the value of $3,322,406 for the corresponding date last year. From January 1 to April 30 of the present year, 1,107 permits of the value of $4,061,166 were issued. This is 185 permits ahead of the corresponding period in 1913 but more than $29,000 less than the value of the permits issued during the first three months of 1913.

Messrs. Parks, Tupper & Kirkpatrick, contractors for the new Marine & Fisheries wharf on the Songhees Reserve, B.C., have started preliminary operations with the driving of piling on the foreshore area. The contract calls for the erection of a creosoted pile wharf, 644 ft. in length, and the excavation and levelling of about 27,000 cubic yards of clay subsoil. The foreshore site is the one on which it is intended to erect the new Marine & Fisheries building, plans for which are now being made at Ottawa.

The number of building permits issued from the office of Mr. S. N. Jarrett, Building Inspector, Vancouver, for April, 1914, is considerably below that of the corresponding month last year. In the latter period 217 permits representing in value $1,103,352 were issued, as compared with 141 permits to the value of $254,166 for April of this year. The total number of permits issued during the four months of 1914 was 558, representing a value of $1,296,604, against 801 permits and $5,179,715 in the corresponding period last year.

Personal Mention

Mr. Thos. Daley, a well-known Toronto contractor for the last half century, died on May 3 in his 88th year. He was a native of Youghal, Ireland, and came to Toronto in 1851.

Mr. Wm. Wainwright, senior vice-president of the Grand Trunk Railway, celebrated his 74th birthday on April 30. Mr. Wainwright began his railway career in 1838 as junior clerk and joined the Grand Trunk Railway in 1862. He is a native of Manchester, Eng.

Mr. W. W. Pearse has been appointed City Architect of Toronto at a salary of $5,000 a year. Mr. Pearse is a native of Toronto, where he graduated more than twenty years ago. He has had considerable experience in architecture and engineering for many years in New York.

Mr. T. P. Howard, Managing Director of the Phoenix Bridge & Iron Works, has been elected Chairman of the Montreal Branch of the Canadian Manufacturers' Association. Among the executive committee are Messrs. B. W. Coghlin, of the B. J. Coghlin Company; Percy S. McKergow, National Brick Company of Laprairie; and R. H. McMaster, Steel Company of Canada.

Major Garnet B. Hughes, son of Col. the Hon. Sam Hughes, has been appointed Government resident engineer for Vancouver Island. Major Hughes is a graduate of the Military College, Kingston, and has been employed under the MacKenzie-Mann Electric Railway at Victoria. There will now be two resident engineers on the Island. The work being carried on in Victoria Harbor is under the supervision of Mr. F. J. McLachlan, while Major Hughes will have charge of the remainder of the work on the Island.

The Tiffin Wagon Company, of Tiffin, Ohio, are issuing a fine new illustrated catalogue describing their new Tiffin Model "A" ten-passenger park and sight-seeing car. There are few builders of cars of this type. Experts pronounce the new Tiffin product to be one of the finest of its kind on the market.

Messrs. Lecky & Collis, Limited, have removed to 49 Beaver Hall Hill, Montreal. The Laurie Machinery Company, Limited, are occupying the premises vacated by Lecky & Collis, at 335a Craig street west.

Head Office and Works, General Car and Machinery Company, Montmagny, Que.

The Industrial Expansion of a Prominent Quebec Firm

The General Car and Machinery Works, Limited, Montmagny, Que.

The General Car and Machinery Works, Limited, whose main office and plant are situated at Montmagny, Que., was formed in 1912 with a capital stock of one million dollars. The company was organized to manufacture machinery and more particularly road-making machines, it being an amalgamation of the Charles A. Paquet Company, Limited, Quebec, and the Montmagny Manufacturing Company, Limited, Montmagny. Both these firms had many years' experience as manufacturers of high-grade machinery and the amalgamation has been eminently successful.

In the possession of technically-trained men at the head of affairs, well-balanced organization and skilled labor, the company have at their command all the essential elements of a big organization. Their plant is of modern design and the firm enjoy unexcelled facilities for manufacturing. They have added to their various departments a steel foundry, which makes them dependent on no other firm for their material.

The President, Mr. Charles A. Paquet, started business on his own account twenty years ago. The rapid growth of the business soon necessitated extension of management and capital. In 1902 he formed a company called The Charles A. Paquet Company, Limited, of which he was president and manager until 1912, when the firm merged with The General Car and Machinery Works, Limited. He has been promoter and organizer of many industrial companies, in several of which he has held the position of president and director.

Mr. Ernest Roy, K.C., the Vice-President of the firm, is interested in many important business undertakings. For

Mr. Chas. A. Paquet, President. Mr. J. H. Paquet, Secretary and Treasurer. Mr. Ernest Roy, K.C., Vice-President.

Officers of the General Car and Machinery Company, Montmagny, Que.

years he was president of The Montmagny Manufacturing Company, and he had charge of the legal work involved in the organization of the new company.

Mr. J. Henri Paquet, Secretary and Treasurer, is a younger brother of Mr. Charles A. Paquet, of the firm of Charles A. Paquet, Limited. His extensive experience was a valued factor in the organization of The General Car and Machinery Works, Limited.

Mr. A. N. Normand, the firm's manager, at an early age acquired a reputation as an inventor of machinery. In 1896 he started a small machine shop at Montmagny. The business grew with remarkable rapidity until the enlargement of the plant became necessary. In 1902 he founded The Montmagny Manufacturing Company, Limited. The excellence of the products of this firm were proved time and again in competition with machinery of the highest grade manufactured elsewhere. Simultaneously with the coming in line of road-making machinery, the Montmagny road-making outfits were placed on the market, and have succeeded ever since in maintaining a high standard. Mr. Normand was managing director of the Montmagny Manufacturing Company from its inception until its amalgamation with The General Car and Machinery Works, Limited.

The Tiffin Wagon Company, Tiffin, Ohio, have just delivered three street flushing machines to the city of Ottawa The order was obtained through the firm's Canadian agents, Messrs. Francis Hankin & Company, Montreal.

One of the most interesting engineering feats of modern times—the raising of the U. S. battleship Main in Havana harbor, is described in detail in an interesting booklet issued by the Lackawanna Steel Company, for whom Messrs. H. A. Drury Company, Limited, Montreal, are the Canadian agents Lackawanna steel sheet piling was employed in the above undertaking.

The Nobis Engineering Company, of Toronto, engineers and contractors, have secured the contract for the "Welo" system of atmospheric pressure steam heating of the new building on Victoria Street, Toronto, for the United Typewriter Company. The Nobis Company are also installing the heating and power plant systems in the new Toronto factory of the National Cash Register Company.

A booklet showing the increased use of Bitulithic pavement in the United States and Canada is issued by Messrs. Warren Brothers Company from their executive office, 59 Temple Place, Boston, Mass. This publication contains many chapters of interest to municipal men and is well worth careful perusal. Extracts from the leading technical journals on both sides of the line are given, the Contract Record being quoted at length in an article, "Bitulithic Paving Construction in Western Canada," published in our issue of January 29, 1913. The development of Bitulithic pavement is shown by the fact that in the year 1901 seven cities possessed 16,400 square yards, while at the end of August last year there were nearly 7,000,000 square yards laid and under contract in 128 cities. Commissioners of works, city engineers, street superintendents and others attest the satisfaction which this pavement has given under exacting requirements.

The "Garrow" contractors' acetylene flare light has just been placed on the market by the Sudbury Construction and Machinery Company, Limited, at Sudbury, Ont. The strong feature of this new light is its durability combined with simplicity of construction. The light, which is entirely of steel assembled by the oxy acetylene welding process, consists of but three parts and is made to withstand the roughest handling by unskilled labor without injury. One of the distinct advantages of the "Garrow" light is its adaptability for use in confined spaces, such as tunnels, mines, etc., without the slightest danger from escaping gas so commonly found in lights of this character. The "Garrow" light eliminates entirely the risk of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame. The Sudbury Construction and Machinery Company is equipped to manufacture this light in considerable quantities.

Operations of the Dominion Lime Company, Sherbrooke, Que.

THE Dominion Lime Company of Sherbrooke, Que., whose advertisement appears on page 287 of this issue, was established about thirty-five years ago and is well known throughout Canada and the Eastern States. Its business has increased from year to year, until the demand for their popular line has necessitated the enlargement of their plant. Heretofore the company used wood in the manufacture of lime, but a gas plant of the latest type has been recently installed which is producing a lime of very superior quality. This plant is the only one of its kind and probably the most up-to-date in Canada. Having doubled the capacity of the output the company are now in a position to meet the increasing demand for their lime.

The works are located about thirty miles from Sherbrooke, on the Maine Central Railroad, which is a convenient shipping point to places on this road as well as to Quebec Central, C. P. R. and G. T. R. points. The quarry from which the rock is produced, and which is in close proximity to the plant, is probably one of the most valuable in the country, and although it has been worked for the last thirty-five years, the supply is apparently inexhaustible. The quarry is equipped with the latest type of steel side-dump cars, drills and other apparatus. Cars are taken to the top of the kilns by cable incline and returned by gravity to the quarry floor. The new plant is built of steel and concrete throughout, making it absolutely fireproof. It consists of kilns fired by producer gas, engine, blower, etc. The foundations, upper and lower floors, are of concrete. On the firing floor coal is dumped into hoppers and fed to the producer. The oval shaped retort is nine feet long, eight feet wide, and twelve feet deep. Below the grate in the producer is a layer of ashes submerged in water, to prevent air entering from below. On either side of the producer are two sets of pipes, four in all, through which steam is injected at a pressure of 45 lbs. The steam carries the required amount of air necessary to create the gas, which latter passes into brick-lined steel flues, 48 ins. in diameter, running the entire length of the battery and kilns on both sides. The operation of the hopper below the kiln is governed by a lever from the firing floor. The lime is dropped into steel cars and distributed over the concrete cooling floor, 100 ft. x 100 ft. in size, ready for shipment. The steel stack connected with the producer is about one hundred feet in height and stands on a massive concrete foundation, without a guy line or support.

The plant is driven by steam power, generated by boilers embedded in concrete and brick. The fuel used is a high-grade bituminous coal. One of the products of the plant is broken rock, which is sold to contractors for concrete work and street improvement, also to machine companies for fluxing purposes. The company also owns an up-to-date sawmill and plant for the manufacture of lime barrels. The officers of the firm are Messrs. William Farwell, President, Chas. H. VanDyke, Vice President; and Arthur F. Fraser, General Manager.

The "Abram" Cement Tools

The Abram Cement Tool Company, Windsor, Ont., manufacturers of the "wrist motion" line of cement finishing tools, have issued catalogue No. 3 which describes in detail the various labor-saving cement tools manufactured by the firm. To the sidewalk contractor who is anxious to secure time and labor-saving devices it matters not whether his order be a mixer, wheelbarrow, scraper, grading plow, or the automatic sidewalk finishing tools, full satisfaction in the purchase is guaranteed. From the very beginning the firm have sold the Abram tools on the strength that one man can do more and better work with them than three men could do with ordinary tools. The reliability of this guarantee has been proved time and again by the appreciative letters received from satisfied customers and also from the fact that no purchaser has yet disputed the company's claim. The principle on which double action tools work is described in the catalogue under notice and the trowel, an illustration of which is here reproduced, is essentially practical, and possesses the qualities of simplicity and strength. This trowel, which has been patented by the firm, places the "Abram" tools in the forefront as practical, up-to-date time and labor-saving devices. Another essential of the contractor's equipment which the company are also placing on the market is the No. 112, 12-in. "Abram" adjustable handle plastering trowel. This trowel is claimed by the makers to be the best and highest class tool ever produced, possessing as it does the decided advantage of a vertical adjustment of the handle never disclosed before.

Portable Wagon Loaders

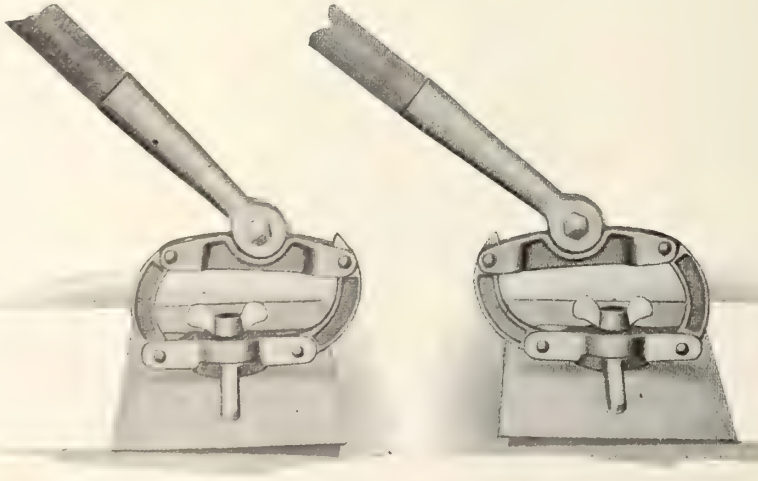
Handling sand and gravel in the old hand-shovel way is hard work, and it is expensive. The last few years have proved that it pays to economize in the loading of these materials, and to-day a light portable machine does the loading that formerly required ten men. The Portable Wagon Loader consists of a steel framework, mounted on wheels, which supports a strong bucket elevator in such a manner that the bucket-elevator can be pushed right into the base of a pile of loose material. The material is assisted to the buckets by the operator. In this way capacities of from 25 to 100 tons an hour can be obtained, depending upon the nature of the material and general conditions. The wagon loader will load a ton a minute or a 5-ton truck with coal in less than five minutes. The newest portable wagon loader completed recently by the Link-Belt Company, of Philadelphia and Chicago, is constructed along the lines as described above, with the addition of self-propelling mechanism for driving in either direction. It is fitted with a platform on which the operator rides, and a steering wheel to control the direction of travel. It can be used to handle coal, stone gravel, sand, cement rock and clinker. The flight conveyor at the end feeds the material with regularity to the buckets and usually takes the place of a shoveller at this end. The portable wagon and truck loaders are described in Link-Belt Company Booklet No. 170.

At Fort William, Ont., building permits for the first four months of the present year totalled close to $600,000. While these figures are much below those of the same period twelve months ago, the number of permits is far in excess of last year.

A survey preliminary to the construction of a sewage system for Redcliffe, Alta., at an estimated cost of $250,000, was completed recently by Mr. W. J. Francis, engineer, of Montreal. Plans are expected to be completed in a few days, on receipt of which the construction of the trunk and lateral sewers will proceed at once and the scheme will probably be completed before the fall.

The Pacific Lock Joint Pipe Company, contractors for reinforced concrete pipe for the flow line of the Sooke Lake waterworks system, have laid the first length of pipe and are now in a position to deliver the stipulated daily quantity of pipe lengths. Between Cooper's Cove and Humpback Reservoir, work on the concrete trestles is proceeding rapidly preparatory to the pipe laying.

The extensions to Fort William's municipally-owned street railway were commenced a few days ago, and during the summer there will be quite a large programme of construction work carried on. The first work to be undertaken will be the construction of the new belt line along North Syndicate and Pacific avenues, Victoria avenue west to Franklin, and Franklin street south to Walsh street. The street railway extension to the Island across the Bascule lift bridge is practically completed, and all that remains to be done are a few connections which will be completed before the end of May.



The "Abram" wrist-motion double action sidewalk finishing trowel.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Que.

The town council is considering the installation of an electric pumping system in connection with the waterworks.

Biggar, Sask.

Prices will be received by the town clerk, F. G. Squirrell, for 4,000 ft. 4-in., 6-in. and 8-in. cast iron water pipe with valves and hydrants, deep well pump 8-in., iron pipe and brass fittings for house connections.

Brampton, Ont.

Surveys have been made for the laying of concrete or cement sidewalks on certain streets, at a cost of $15,000. Engineer, W. M. Treadgold, Brampton, and 13 Woodlawn Ave., Toronto.

Chicoutimi, Que.

Tenders will be called this month for the laying of 4,000 ft. macadam road and sidewalk, and the construction of a concrete wall 600 ft. long and 15 ft. high.

Calgary, Alta.

The ratepayers have passed a by-law providing for the construction of sewers at an estimated cost of $63,836.

The city council has decided to make certain extensions to the waterworks system this summer, at a cost of $250,000.

Edmonton, Alta.

A by-law authorizing the expenditure of $175,000 on a filtration plant was passed last year but owing to a legal formality it may have to be submitted again.

Forest, Ont.

Plans are being prepared by the Dominion Canners, Ltd., for the installation of a filtering plant.

Fort William, Ont.

Tenders will be received by the [illegible] clerk, A McNaughton, until May 20th, for the construction of 40,000 sq. yds. pavement. Specifications, etc., are at the office of the engineer, Ray R. Knight.

Kildonan, Man.

Tenders will be received by [illegible] Little, clerk to the Rural Municipality of West Kildonan, 215 Chmbrs. of Commerce, Winnipeg, until noon May 25th, for the construction of a trunk sewer on Jefferson Ave., and the construction of a [illegible] ft. concrete sidewalk on Main St. Plans and specifications are at the office of the municipal engineer, 216 Chambers of Commerce, Winnipeg.

Montreal, Que., St. Lambert

Tenders will be received by the town council until 6 p.m. May 18th, for the installation of storm and sanitary sewers, street gulleys and manholes. Town Engineer, E. Drinkwater.

Ottawa, Ont.

Plans have been drawn for the construction of pavement on Oliver St. between Bayswater and Irving streets. The approximate quantities are: asphalt, 1,773 sq. yds.; gutter, 985 lin. ft.; curb and gutter, 161 lin. ft.; headers, 30 lin. ft. Estimated cost $6,130. And on Clarence St., asphalt, 1,590 sq. yds.; gutter, 480 lin. ft., curb and gutter, 396 lin. ft.; headers, 114 lin. ft. Estimated cost $6,238.

The city council proposes to lay treated wood block pavement on Henry St., between Coburg and Charlotte St.s

Tenders addressed to the Chairman and Members of the Board of Control, will be received by the Secretary until 4 p.m. May 26th, for the construction of approximately 7,720 sq. yds. of asphalt and 5,650 lin. ft. concrete gutter. Specifications at office of the City Engineer.

The city council will shortly call for tenders for the laying of asphalt pavements on Water, Hinton, Rochester and Munro Sts. Roadway engineer, L. McL. Hunter.

Picton, Ont.

The ratepayers recently voted the sum of $20,000 for the construction of a permanent roadway on Main St.

Redcliff, Alta.

Surveys for the construction of a sewage system, at a cost of $250,000, have been completed, and work will start as soon as plans are ready.

Regina, Sask.

Tenders will be received by the city council until noon May 25th, for the trenching and laying of water mains. Specifications are with the Superintendent, J .M. Mackay.

Stamford Twp., Ont.

Tenders will be received by the engineer, J. Carl Gardner, Niagara Falls, for the construction of a stand pipe, with a capacity of 50,000 to 125,000 gallons. Clerk, Carleton F. Munroe, South-[illegible]

Tenders will be received by the township clerk, C. F. Munro, Niagara Falls South, until May 23rd, for 1¼ miles (22,000 sq. yds.) paving.

Saskatoon, Sask.

Permission has been granted by the Provincial Government to raise the sum of $55,000 for the reconstruction of Long Hall

Sherbrooke, Que.

Tenders for the following cast iron pipe and fittings will be received by the city secretary-treasurer, F. C. [illegible], until noon, May 16th, for 500 ft. 6-in., 12 ft. lengths B. Sp. Class B; 500 ft. 6-in., 12 ft. lengths B. Sp. Class C; 400 ft. 6-in., 12 ft. lengths B. Sp. Class D; 2,000 ft. 8-in., 12 ft. lengths B. Sp. Class B; 2,000 ft. 8-in., 12 ft. lengths B. Sp. Class C; 700 ft. 10-in., 12 ft. lengths B. Sp. Class B; also for about 6 tons of fittings from 4-inch to 10-inch. Each length of pipe is to be marked in white paint for its class, according to the specifications.

Sault Ste. Marie, Ont.

Tenders addressed to the mayor will be received by the Clerk, C. J. Pim, until 5 p.m. May 28th, for the construction of about 84,000 sq. ft. cement concrete walks. Specifications are at the office of the Engineer, W. W. VanEvery.

Thorold, Ont.

Tenders are invited by the city council for the laying of 6,600 sq. yds. pavement on Pine and Mill Sts. Plans are at the offices of the Town Clerk and the Engineers, Chipman & Power, Mail Bldg., Toronto.

Toronto, Ont.

Tenders will be received by the Board of Control until May 26th for the construction of sewers on 16 streets, ten lanes and Midway District Drainage Outlet from Edgewood Ave. Plans, etc. are at the office of the Commissioner of Works.

The time for receiving tenders for the waterworks pumps has been extended from May 19th until June 16th.

The Board of Control will receive tenders until May 26th, for grading Humber River Driveway. Plans are at the office of the Parks Dept.

Toronto, Ont., Newmarket

The town council decided on 5th inst. to expend the sum of $25,000 on extending the mains and increasing the water supply.

Toronto, Ont., Stouffville

The village council proposes to lay 2 miles of walks at a cost of $6,000

Toronto, Ont., Weston

Tenders will be called shortly by the village council for walks on Maria, William, Coulter and Rosemount Aves.

Vermilion, Alta.

The town council has decided to expend the sum of $12,000 on grading and plank sidewalks this year.

Waterford, N.S.

The ratepayers have decided to raise the necessary funds for the construction of sewers, pavements and walks. The estimated cost is $20,000.

Winnipeg, Man., Transcona

The sewage and water system plans have been drawn and approved of by the engineer, H. N. Ruttan, Confederation Life Bldg., Winnipeg.

Wallaceburg, Ont.

Tenders will be received by the town clerk, H. E. Johnson, until 8 p.m., May 26th, for (A-1) laying water mains in town, (A-2) [illegible] constructing pump house; (G) pumping machinery; (I) laying intake; (M) laying steel force main; (R) laying river crossing. Plans are at the offices of the clerk and the engineers.

CONTRACTS AWARDED

Glen Ewen, Sask.
The municipality of Glen Ewen has awarded to F. W. Durst, Suite 2, Yukon Block, Brandon, Man., the contract for the laying of 8,250 square feet of cement walks, and 9,500 square yards street grading. The contractor is to furnish all material.

Quebec, Que.
A contract has been awarded by the Provincial Government Highways Dept. to O'Brien & Doheney, 46 Dalhousie St., for the construction of a 16-ft. highway road, 33 miles long.

Riviere du Moulin, Que.
A contract for the laying of sewers and sidewalks has been awarded by the municipal council to Jno. Girard, Chicoutimi.

Saskatoon, Sask.
The contract for the construction of storm sewers has been awarded by the city council to R. J. Lecky, 24th and Crescent Sts.

Selkirk, Man.
A contract has been awarded by the town council to Schruth & Co., Winnipeg, for the laying of 2 miles of sidewalks at $1.63 per yd.

Toronto, Ont.
The following sidewalks contracts have been awarded by the Board of Control. Standard Concrete Co., 74 Moscow Ave.; S. Walker, 406 Dundas St.; W. E. Ransom, Dineen Bldg.; Ramsay Contracting Co., 39 Indian Rd. Cres.; Grant Contracting Co., 50 Front St. E.; A. J. Penberthy, 292 Booth Ave.

Trenton, N.S.
The contract for waterworks supplies has been let by the town council to Doane Engineering Co., 25 Young Ave., Halifax, N.S.

Windsor, Ont.
The following additional contracts for waterworks supplies have been awarded by the city council. Kerr Engine Co., Walker Rd., Walkerville. 35 valves, at $9.75 each, 8 valves at $16.75 each; Rae-Stevens Co., 10 hydrants $40 each, delivered and duty paid.

Railroads, Bridges and Wharves

Brampton, Ont.
Surveys have been made for the construction of a concrete and steel bridge on Main St. Engineer, Wm. M. Treadgold, Brampton, and 13 Woodlawn Ave., Toronto.

Calgary, Alta.
A by-law is to be submitted to the ratepayers on May 14th for authority to construct (1) a concrete bridge over Bow River at Centre St., to cost $375,000; (2) a concrete bridge over Elbow River at 4th St., to cost $77,600; and (3) a steel bridge over Bow River at 9th St. W., to cost $60,000.

Fredericton, N.B.
Tenders will be received by R. C. Desrochers, Secretary to the Public Works Dept., Ottawa, until 4 p.m. May 20th, for the dredging required from Springhill to Fredericton, St. John River. Specifications are at the office of the Dept., Ottawa.

North West Cove, N.B.
New tenders on the Tancock Island breakwater are invited by R. C. Desrochers, Public Works Dept., Ottawa

Owen Sound, Ont.
The contract for the pile driving in connection with the renewal of the wharf at the C. P. R. slip, has been awarded to the local firm of Bishop and Buchanan.

Port Coquitlam, B.C.
Tenders will be received by J. E. Griffith, Public Works Dept., Victoria, until noon May 26th, for the construction of the substructure for Pitt River Bridge. Plans, specifications, etc., are at the offices of Govt. Agents, Vancouver, New Westminster, and at the office of the Deputy Minister, Parliament Bldgs., Victoria. A 6-ft. right-of-way from the Dewdney Trunk Rd. to the bridge-site on both sides of the river will be provided as shown in the drawings.

St. Catharines, Ont.
Tenders for the completion of the high level bridge will be received by the City Clerk, J. A. Pay, until 5 p.m. May 26th. Specifications and information can be had at the office of the engineer, W. P. Near.

Toronto, Ont.
The York township council has decided to replace the old wooden structure by a concrete culvert. F. Barber, Engineer, 57 Adelaide Street East.

Vaughan Twp., Ont.
The township council contemplates replacing a number of wooden bridges with concrete structures.

CONTRACTS AWARDED

Cornwall, Ont.
The contracts for the construction of the Cornwall & Glengarry Railway Co.'s line to St. Polycarp, Que., have been awarded to G. Philips, Cornwall, for 4 miles; A. F. Mulher, Cornwall, Grant & McDonald, Cornwall, for 12 miles; MacArty Co., Cornwall, for 8 miles.

Markham Twp., Ont.
The bridge contract has been awarded by the township council to H. E. Croft, Guelph.

Moore Twp., Ont.
The bridge contract has been awarded by the township council to the Petrolea Bridge Company, Petrolea.

McGillivray Twp., Ont.
The contract for the construction of three bridges has been awarded by the township council to David Witherspoon, Ailsa Craig, at $5.00 per cu. yd.

Port Arthur, Ont.
The contract for extension to the new breakwater has been awarded by the Public Works Dept., to the Port Arthur Constr. Co., Ltd., Port Arthur.

Toronto, Ont., Cedar Grove
The Rouge River bridge contract has been let by the Markham Twp. Council to Croft & Co., Guelph.

Toronto, Ont., Islington
The bridge contract has been awarded by the Etobicoke Twp. Council, to I. M. Scott, Lambton Mills.

Victoria, B.C.
The sub-contract for steel work in connection with the wharf and dock construction has been secured by E. G. Prior & Co., Ltd., 1401 Government St.

Public Buildings, Churches, Schools, etc.

Aylmer, Ont.
Tenders for interior fittings at the post office and customs house will be received by R. C. Desrochers, Secretary, Public Works Dept., Ottawa, until 4 p.m. May 19th. Plans and specifications are at the offices of Thos. Wooster, Supt. Architect, Aylmer; T. A. Hastings, Clerk of Works; Postal Station "F," Yonge St., Toronto, and at the Dept., Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Barrie, Ont.
Tenders for the erection of the drill hall will be received by R. C. Desrochers, Secretary, Public Works Dept., Ottawa, until May 27th. Plans are at Station "F," Toronto, Post Office, Barrie, and at the Dept., Ottawa. Specifications at office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Beauport, Que.
Tenders for the new post office close with R. C. Desrochers, Public Works Department, Ottawa, June 1st. Plans are at the office of the Architect, J. H. Lebon, 20½ D'Aiguillon St., Que., the Postmaster and at the Dept., Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W. Toronto.

Calgary, Alta.
A by-law providing for extensions to the public market at a cost of $20,000, has been carried by the ratepayers. The work will be done during this summer.

Edmonton, Alta.
Tenders for the erection of the First Church of Christ Scientist, are invited by Geo. Trust, 22 Victoria Block.

South Edmonton, Alta.
Tenders for an 8-room addition to Rutherford St. School will be called shortly. The architect is Mr. Turner, Mortlake Block.

Ford City, Ont.
The town council has passed a by-law providing for the erection of a town hall, at a cost of $35,000.

Hampton, N.B.
Plans and specifications for the new Methodist Sunday School may be seen at the Methodist parsonage where tenders will be received until May 18th.

Irvine, Alta.
Plans for a $12,500 public school are being drawn by W. T. Williams, architect, Williams Block, Medicine Hat.

Kildonan, Man.
The question of the erection of a municipal hall, at a cost of $15,000, will be submitted to the ratepayers on May 29th.

Kamsack, Sask.
A site on West Ave. and Nicholas St.,

has been purchased by the Holy Trinity Anglican Church Congregation, but the new church may not be built for some time yet.

Listowel, Ont.
Tenders for the erection of a drill hall will be received by R. C. Desrochers, Public Works Dept., Ottawa, until June 1st. Plans are at Station "F," Toronto, Post Office, Listowel, and the office of the Dept., Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Midland, Ont.
Tenders for post office fittings will be received by R. C. Desrochers, Public Works Dept., Ottawa, until May 20th. Plans are with R. Iles, Midland; Station "F," Toronto, and office of the Dept., Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Milton, Ont.
Tenders for the erection of a post office will be received by R. C. Desrochers, Public Works Dept., Ottawa, until May 28th. Plans are at the office of Station "F," Toronto, Postmaster, Milton, and at the Dept., Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Norwich, Ont.
Tenders for the erection of a post office and customs house will be received by R. C. Desrochers, Public Works Dept., Ottawa, until May 28th. Plans are at Station "F," Toronto, Post Office, Norwich, and at the office of the Dept., Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

New Waterford, C.B.
Tenders for the erection of a church for the Presbyterian Church Congregation will be received by J. C. Morrison, Plumner Ave. W. S. Spencer, Sydney, C.B., is the architect.

Ottawa, Ont.
Plans are being drawn for additions to the court house, etc., on Nicholas St. C. J. Burritt, Booth Bldg., Sparks St., is the architect.

The erection of a church is contemplated by the Oblate Fathers, St. Joseph Branch, Ottawa E.

Paisley, Ont.
Tenders for the erection of a public school building will be received by the Secretary, W. R. Barnett. Plans are at the offices of the secretary, the architect, Jas. L. Russell, 21 Downie Street, Stratford, and Hugh C. MacLean, Ltd., 220 King St. W., Toronto, until May 27.

Port Dover, Ont.
Tenders will be received by the Board of Education until May 23rd, for hot water or steam heating for a 8-room school. Plans can be had on application to the Secretary, T. W. Smith.

Quebec, Que.
J. A. Pinsonnault, of the city hall, is the architect for the new city hall fire station.

Regina, Sask.
Successful tenderers for the nurses' home will be asked to furnish an estimate for tunnel from hospital to nurses' home, plans for which are being prepared.

Redcliff, Alta.
The city council proposes to build a brick addition to the city hall for the accommodation of the fire department.

Sussex, N.B.
Tenders for the erection of a drill hall will be received by the Director of Contracts, Ottawa, until noon May 26th. Specifications are at the office of Officer Commanding 6th Division, Halifax, N.S., the Town Clerk, Sussex, and the Director-General of Engineer Service, Head quarters, Ottawa.

Summerland, B.C.
The Hospital Board has awarded the hospital contract to Harry Tomlin, Summerland.

Toronto, Ont.
Tenders for finishing the interior of the Government house will be received by H. F. McNaughten, Secretary, Provincial Govt. Dept. Public Works, Parliament Bldgs., until May 26th, for carpentry and joinery, plastering, painting and glazing, marble and bronze work. Plans, etc., are at the office of the Department.

A site is to be selected in the west end for the erection of a Forest School, at a cost of $15,000.

Plans for the erection of a new church for the North Earlscourt Methodists, have been drawn by Burke, Horwood & White, architects, Ryrie Bldg. Tenders will be called shortly.

Tenders close May 15th for heating and ventilating, heat regulating, plumbing, electric wiring at Western Ave. School. Plans are at office of Board of Education.

Tenders for all trades on additions to Davisville School close at the office of the Board of Education, where plans may be had on May 15th.

Toronto, Ont., Fairbank
Plans are being prepared for a 4-room addition to the school, and tenders will be called shortly. Lindsay & Brydon, Trinity Sq., Toronto, are the architects.

Toronto, Ont., Lambton Park Dist.
The erection of a 2-room school is contemplated by School Sec. No. 24, York

Truro, N.S.
The premier, the Hon. G. H. Murray, has introduced a bill respecting a loan for the erection of a science building at the agricultural farm.

Plans for the erection of a $40,000 school building are invited by the School Board. Only the successful set will be paid for.

Uxbridge, Ont.
Tenders will be received by Eugene Fiset, Dept. of Militia & Defence, Ottawa, Ont., until May 18th, for the construction of a [illegible] rifle range. Plans are at the office of the town clerk, the Director-General of Engineer Service, Headquarters, Ottawa, and Military Headquarters, Toronto, Ont.

Vancouver, B.C.
Preliminary sketches have been prepared by construction superintendent Giles for the erection of "Strathcona" School. The estimated cost is $100,000.

Welland, Ont.
The Welland county council has accepted the sketches for additions and alterations to the Registry Office, drawn by C. M. Borter, Main St., Niagara Falls, and instructed him to prepare plans and specifications. Tenders to be called shortly. The estimated cost is $20,000.

Winnipeg, Man.
Plans are in progress for the erection of a $200,000 school on Helen and Fleet Sts. J. B. Mitchell, William and Ellen Sts., is the architect.

The erection of a church on River Heights is proposed by St. Andrews Presbyterian Church, Elgin Ave.

North Winnipeg, Man.
Tenders for the erection of a drill hall on Machray and McGregor Sts., will be received by R. C. Desrochers, Public Works Dept., Ottawa, Ont., until June 8th. Plans are with the residential architect, H. E. Matthews, and the Department, Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Weyburn, Sask.
Tenders for the erection of the city hall and fire hall will be received by the city secretary-treasurer, F. Inwards, until May 23rd. Plans and specifications are at the office of the secretary-treasurer, the architect, B. O. Boyum, Minneapolis, Minn., U.S.A., and Builders' Exchange, Winnipeg, Moose Jaw and Regina.

CONTRACTS AWARDED

Assiniboia, Sask.
The school contract has been awarded by the School Board to H. R. Ford, Weyburn, $17,000. Tenders for heating not yet called.

Birds Hill, Man.
The school contract has been awarded by the School Board to Owens & Sander, King Edward P.O., Man.

Frobisher, Sask.
The school contract has been awarded to R. N. Wyatt, Melita, Man.

Port Alberni, B.C.
The post office contract has been awarded by the Public Works Department to Knott & Jones, 1327 Pandora St., Victoria.

Toronto, Ont.
The contract for marble work in connection with the interior alterations to St. James' Cathedral, King and Church Sts., has been secured by [illegible] Dunham Co., 145 Church St.

Windsor, Ont.
The Wyandotte St. Public School contract has been secured by H. G. Christman Co., Main and Hughson Sts., Hamilton, Ont.

Business Buildings and Industrial Plants

Allandale, Ont.
W. J. Gilks, of Ross St., Barrie, is considering the erection of a hotel. Plans are to be prepared shortly.

Brantford, Ont.
C. J. Mitchell, 55 Darling St., is nego-

ating for a site on Darling St. for the erection of a garage at a cost of $10,000. The architect is not yet appointed.

Brampton, Ont.
A permit for the erection of a flour mill, at a cost of $10,000, has been granted to the Canada Grain Co., Colborne and Yonge Sts.

Glencoe, Ont.
McAlpine & McEachren, Main St., propose to erect a grain elevator at a cost of $5,000.

Kingsville, Ont.
Tenders for the erection of a factory for the Dominion Stove Company will be received by the architect, J. C. Pennington, LaBelle Bldg., Windsor, until May 23rd. Estimated cost $12,000.

Lethbridge, Alta.
A site on MacLeod Rd., has been purchased by the Lethbridge Face Brick & Clay Products, and work on a brick plant is to start at once.

Listowel, Ont.
The Dominion Milk & Flour Co., Ltd., proposes to spend the sum of $35,000 on an equipment for the manufacture of butter and milk powder. The town may grant a loan of $10,000.

Major, Sask.
Tenders for the erection of a hotel are invited by F. A. Hoeft, who has plans and specifications ready for inspection.

Montreal, Que.
A permit for the erection of a store and two flats on Daniel Street, at a cost of $6,000, has been issued to Wm. McDiarmid, 2935 St. Andre.

Plans are being drawn for stores and flats on St. Hubert Street, estimated to cost $10,000, for Mr. W. Lacroix, by Beaugrand-Champagne & Chenevert, architects, 182 St. Catherine St. E., who will receive tenders until May 25th.

A permit for alterations to store and flat, on St. Catherine E., at a cost of $6,000, has been issued to Amb. Genereux, 60 Wm. David.

Montreal, Que. (Longueuil)
Plans are being drawn for the erection of stores and flats for Mr. Jno. Girouard. The architects, Beaugrand, Champagne & Chenevert, 182 St. Catherine St. E., will be open for tenders on June 1st.

Preston, Ont.
Building Product Company, Limited, of Toronto, is negotiating with the town authorities for a loan and certain exemptions in regard to the proposed brick plant.

Regina, Sask.
The Metal Shingle & Siding Company of Preston, Ont., has purchased a site and arrangements are being made for the erection of a warehouse.

A permit for extensions has been granted to the Dom. Dairy Co., Ltd., McIntyre and 6th Ave. General contractors, Wilson & Wilson, Westmann Chmbrs.

A permit for the erection of stores on Albert St., at a cost of $20,000, has been granted to Merrill & Gardner, 2074 Cornwall St.

A site for the erection of an office building, has been secured on 11th and St. John St., by Andreas Ehmann, 1501 11th Ave. Estimated cost $20,000.

Saskatoon, Sask.
Plans for an $80,000 stores and offices block are being drawn for H. Devere Cole, by R. S. Byers, 602 Standard Trust Bldg.

Toronto, Ont.
R. W. Burnaby, 1844 Yonge St., has purchased a site at Davisville for the erection of a planing mill.

The erection of a storage warehouse is proposed by H. W. Beauclerk, of Transportation Bldg., Montreal, Que. The scheme is being financed, but details are not yet settled.

Toronto, Ont., Lambton Mills
Mr. Home Smith, 18 Toronto St. W., Toronto, proposes to alter the old mill into a restaurant, lodge and assembly hall.

Waterloo, Ont.
A by-law granting a loan of $50,000 to the Globe Furniture Company has been carried, and the company will erect additions at a cost of about $125,000.

Weyburn, Sask.
A company, in which Mr. E. V. Campion is interested, is being formed for the erection of a skating and curling rink, at a cost of $35,000.

Westboro, Ont.
Plans for a tennis and bowling pavilion, courts, etc., have been drawn for the Highland Park Club, by Richards & Abra, architects, Booth Bldg., Ottawa.

Yorkton, Sask.
The town council proposes to erect a skating rink with a seating capacity of 2,000.

CONTRACTS AWARDED

Eburne, B.C.
The contract for the construction of a sawmill for the Huntting-Merritt Lumber Co. has been secured bv Heaps Engineering Co., Supt., J. J. Daley, 325 Front St., New Westminster.

Montreal, Que.
The following sub contracts have been awarded on the National Trust Co. office building, 153 St. James St. Stone, Argenteuil Granite Co., Ltd., 42 Craig St. W.: steel, Structural Steel Co., Ltd., New Birks Bldg.; contracts are to be awarded shortly for the other trades.

Montreal, Oue., St. Henry
The contract for addition to C. H. Johnson & Sons factory, on Dagenais St., has been let to A. F. Byers Co., 340 University, who will receive tenders on some sub trades later.

Regina, Sask.
A contract for the erection of stores and offices for J. Schwartzfeld, 1337 1th Ave., has been secured by A. W. McGregor, 8 Masonic Temple.

Stratford, Ont.
The contract for the erection of the John S. Morelock upholstering factory has been secured by Frank Prast, Inkerman St., Hanover.

Welland, Ont.
The contract for additions to the foundry of the Welland Machine & Foundries, Ltd., has been secured by W. J. Hickey, 91-93 Main St. E.

Winnipeg, Man.
The contract for addition to the premises of McNeil, McLean & Garland, on Portage and Smith Sts., has been let to Hazelton & Walin, Donalda Block.

Weyburn, Sask.
The contract for the erection of Mr. F. Moffat's store and office has been secured by Frank Rooney, Weyburn.

Residences

Brantford, Ont.
Plans for a $7,000 residence on Brant Ave., for Gilbert Brereton are being drawn by L. D. Barber, Temple Bldg., who will receive tenders until May 20.

Charlottetown, P.E.I.
Plans for the erection of a $40,000 residence on Mount Edward Rd., for Mr. J. R. Dinnis, are being drawn by C. B. Chappelle, architect, Box 93 Charlottetown.

Cedar Springs, Ont.
Plans for the erection of a residence at a cost of $7,000, are being drawn by J. L. Wilson & Son, 64 Market Bldg., Chatham, for Mr. Geo. Smith.

Eastview, Ont.
The erection of a tenement, at a cost of $5,000, is contemplated by M. Brownlee, Elm St.

Montreal, Que.
The plans for the 10-storey apartment house on Sherbrooke W., drawn by Ed. Maxwell, 6 Beaver Hall Sq., are being altered. New tenders will be called in a few days on stone, carpentry, ornamental iron and plastering.

Recent permits for residential building, include the following: R. Rivest, 5 flats on St. Denis St., $6,000; E. Lafrancois, 2 flats on Chambord St., $6,000; Wm. Harvey, 2 residences on Marchmount St., $11,800; H. B. Pope, cottage on Old Orchard, $15,000; Madame N. B. Desrochers, 3 flats on Bordeaux St., $6,000; Boileau & Dumontier, 6 flats on Marcil St., $12,000; A. Langlois, alterations to flats on St. Hubert St., $9,000.

Montreal, Que., Rosemount
A permit for the erection of flats on 10th Ave., at a cost of $6,000, has been granted to L. S. Beaudry, 1139 Messier St.

Montreal West, Que.
Plans for a $6,000 residence are being drawn for Mr. H. L. Trotter by Peden & McLaren, architects, 20 St. Alexis St., Montreal, who will reveive tenders until May 22nd.

Montreal, Que., Westmount
The erection of a number of $6,000 residences on Lansdowne Ave., is being considered by St. George Harvey, 136 St. James St.

W. E. S. Dyer, c/o Canadian Steel Foundries Ltd., Transportation Bldg., Montreal, has under consideration the erection of a residence, at a cost of $9,500.

Oakville, Ont.
Tenders for the erection of a residence, on the Brantwood Survey, are in-

vited by the Architect, F. S. Baker, Royal Bank Bldg., Toronto, until noon May 23rd.

Ottawa, Ont.

The erection of a residence on Powell St., at a cost of $6,000, is being considered by J. A. Scott, 46 Brighton.

The erection of a $5,000 residence on Bellwoods Ave. is proposed by the Oakland Land Company.

The erection of a $5,000 recidence on Pansy street is contemplated by John Bois, 5 Roslyn.

N. D. Porter, cor. Albert and Bank Sts., proposes to make certain additions to his apartments on McLaren St., at a cost of $5,000.

The erection of a residence on Marlboro St., is contemplated by S. Cohen, Osgoode Station; estimated cost $9,500.

A. W. Davidson, 60 Grosvenor St., propose to erect a $5,000 residence on Sunnyside.

The erection of a residence on Linden St., is being considered by Richard Hooper, 14 Monkland Ave. The estimated cost is $10,000 to $12,000.

The erection of an apartment house on Cumberland St. is contemplated by J. G. Bresson, 638 Cumberland.

F. L. Campbell, 219 5th Ave., has under consideration the erection of a $5,000 residence on 5th Ave.

W. H. George, Castle Bldg., Queen St., has drawn plans for the erection of a $3,500 residence on Clemow St., for V. M. Davis.

W. H. Craig, 174 4th Ave., proposes to erect a residence on 4th Ave., at a cost of $6,000.

Prince George, B.C.

[illegible] & Harrison, 114 Sayward Bldg., Victoria, have drawn plans for the erection of a $10,000 residence, for D. A. Brewster.

Regina, Sask.

Cameron & Nicol, Black Block, are considering the erection of a $45,000 apartment block on Leopold Crescent.

A permit for the erection of a residence, at a cost of $10,000, has been granted to Thos. Wilkinson, 2009 Angus street.

Plans for an apartment block on 14th and Robinson, have been drawn by the Beta Apartment Co., Ltd.

The erection of an apartment block, on 16th and Cameron, is proposed by R. M. Moore, 1459 Albert St. The estimated cost is $15,000.

Sault Ste. Marie, Ont.

Plans for the erection of a double residence, at the corner of Wellington St. and Woodward Ave., are being drawn by Moran & McPhail, 752 Queen St., who invite tenders.

Plans for the erection of a [illegible] bungalow on Wellington St. for R. H. Carney are being drawn by Moran & McPhail, 752 Queen street.

Toronto, Ont.

Tenders on the erection of a residence on Highview Ave., are invited by the architects, [illegible] & [illegible], [illegible] Confederation Life Bldg.

Sketch plans for apartments at the northeast corner of St. Clair and Avenue Road have been filed with the Board of Control by Farmer & Gates, Adelaide St. W.

The erection of a 2½ storey residence of brick and mortar construction is being considered by Henry R. Flett, 460 Marion street.

R. A. Leighton, 2113 Davenport Road, is now open to receive tenders for all trades on the erection of a 2½ storey brick residence.

Tenders for the erection of a residence, on Hutchinson St., are invited by the Architect, Jas. Mitchell, 55 Isabella St., until May 20th.

R. A. Cardwell, 282 Queen St. E., invites tenders on all trades connected with the erection of a residence on Browning Ave.

G. W. Hambly, 526 Dovercourt Rd., has purchased a site on Dunvegan Ro., and proposes to erect a residence thereon.

T. P. Kent, 366 Walmer Rd. Hill, has drawn plans for three detached residences on Walmer Rd., and will sublet all trades.

Plans have been drawn for a detached residence, on Parkway Ave., for W. J. Herod.

Plans for the erection of a $5,000 residence, on Rose heath Ave., have been drawn for H. B. Jones, 218 Clinton St.

Truro, N.S.

Leslie R. Fairn, Aylesford, N.S., has drawn plans for a $5,000 residence on Park St., for C. B. McMullan.

Winnipegg, Man.

A permit for the erection of a residence on Niagara Ave., at a cost of $10,000, has been issued to P. McDiarmid, 704 Canada Bldg.

P. S. Wright, 12 Harrow Apartments, has purchased sites on River Heights for the erection of two residences.

A permit for the erection of a residence, on Oak St., at a cost of $7,000, has been issued to Whitla & McFadyen, 601 Electric Railway Chambers.

CONTRACTS AWARDED

Montreal, Que.

A contract for alterations to two flats on Demontigny street has been let by L. A. Gagnier to M. Gerard, 112 Drolet street.

Montreal, Que., Outremont

The contract for the erection of a residence, on Wilder St., for C. W. Duckett, has been let to C. W. Strang, 12 Plymouth Grove.

Montreal, Que., Westmount

The contract for the erection of a detached residence, on Aberdeen Ave., for R. S. Buck, has been secured by Chas. Brown, 4263 St. Catherine St.

Niagara Falls, Ont.

The contract for the erection of a residence in this locality for W. L. Doran, has been secured by [illegible] & [illegible], Empire Block.

Ottawa, Ont.

The contract for the erection of a residence, on Clarence St., for Jno. Black, has been awarded to M. E. Davis, Booth Building.

The contract for the erection of a residence, on Wendover St., for J. E. Beckwith, has been let to L. A. Davis, 139 McLeod.

Regina, Sask.

The contract for the erection of an apartment block, on 13th and Halifax, for H. Dutton, has been awarded to H. Black, 17 New Black Block.

Saskatoon, Sask.

The contract for the erection of a residence on Broadway Ave., for Dr. A. McG. Young, has been secured by Miners & Ball, Ltd., 614 9th St.

Woodstock, Ont.

The contract for the erection of a residence for Geo. Otton, has been secured by McKinney Lumber Co., Ingersoll Ave.

The following contracts on the erection of a residence, on George and Wellington Sts., for C. Thornton, Princess St., have been let. Masonry, W. J. Bond, 836 Water St.; carpentry, McKinney Lumber Co., Ingersoll Ave.; the heating and plumbing contract is still open.

Weyburn, Sask.

The following contracts have been awarded in connection with the erection of the apartment block for Mr. Wm. Little. General contractor, Carlisle Janousky; heating and plumbing, Gallagher & Lythegoe.

Power Plants, Electricity and Telephones

Edson, Alta.

The necessary debentures having now been sold, the town authorities will proceed with the installation of an electric lighting and power system at an estimated cost of $45,000.

Grenfell, Sask.

Permission granted by the Provincial Government to the town council to raise the sum of $6,500 for extensions to the electric lighting plant.

Hagersville, Ont.

The village council is considering extensions to the hydro-electric system, at a cost of $3,300.

Little Current, Ont.

The ratepayers will be shortly asked to vote on by-law to raise the sum of $12,000, for the purchase of site and erection of necessary buildings for the proposed electric lighting plant.

London, Ont.

The Globe Casket Works, Dundas St., are about to purchase a 30 h.p. 3-phase motor.

Maryfield, Sask.

The village authorities are considering the erection of a telephone exchange building.

Ottawa, Ont.

The re-wiring and re-lighting of Howick Hall in the Exhibition Grounds are being considered by the city council.

Sydney Mines, C.B.

Plans for a electric car line to Florence are being drawn by the Cape Breton Electric Co., Ferry Wharf, Sydney.

Welland, Ont.

The town council has applied to the Provincial Commission to have a survey and report made on hydro radials.

Tenders and For Sale Department

TOWN OF ST. LAMBERT, P.Q.

Sewers

Sealed tenders will be received up to 6 p.m., **May 18th, 1914**, for the installation of Storm and Sanitary Sewers, Street Gulleys and Manholes.

Plans may be seen and specifications and tender form had on application at the office of Town Engineer on and after the 9th inst.

The Town reserves the right to divide the work into two or more contracts, and reject any or all tenders.

E. DRINKWATER,
19 Town Engineer.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, May 26th, 1914**, for the construction of the following sewers, viz.:—

Burgess Ave., Woodbine Ave. to East End.
Cassels Ave., Woodbine Ave. to East End.
Cedarvale Ave., Danforth Ave. to South End.
Devon Road, Gerrard Street to Cassels Ave.
Dewson Street, Shaw Street to Crawford Street.
Eighth Street, Woodbine Ave. to Fifth Street.
Ethelwin Ave., Cedarvale Ave. to East End.
Fifth Street, Eighth Street to Fourth Ave.
Golview Ave., Cassels Ave. to G. T. R.
Hiawatha Ave., Vernon Rd. to 516 ft. north.
Iona Ave., Oakcrest Ave. to Keystone Drive.
Keystone Drive, Cedarvale Ave. to East End.
Kingswood Ave., Kingston Road to Lyall Ave.
Lane 2nd south Bloor St., Crawford St. to Shaw Street.
Lane 1st north College St., Grace St. to west end, Queen St. to Humbert St.
Lane 1st north Collegt St., Grace St. to west end, thence north and west to Beatrice St.
Lane 1st east Dovercourt Road, north side Humbert St. to south side Foxley Street.
Lane 1st east Dovercourt Road, from lane 1st north Queen St. to Humbert St.
Lane 1st west Dundas St., Queen St. to Humbert Street.
Lane 1st north Queen St., Brock Ave. to East End.
Lane 1st north Queen St., east side Dovercourt Road to lane 1st west Dundas Street.
Lane 1st north Queen St., Northcote Ave. to Beaconsfield Ave.
Lane 1st west Sorauren Ave. from lane 1st north Queen Street to north end.
Midway District Drainage Scheme Outlet from Edgewood Ave. and Small Street to Patricia Road and Glenmore Road via Small Street and Patricia Road.
Second Street, Gerrard Street to Eighth Street.
Third Street, Gerrard Street to Eighth Street.
Walpole Ave., Morley Ave. to Hiawatha Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, May 6th, 1914. 19

CITY OF WINNIPEG

Tenders for Street Name Posts and Name Plates

Sealed tenders addressed to the Chairman, Board of Control, will be received at the office of the undersigned up to 11 a.m. on **Monday, June 15th, 1914**, for the supply of street name posts and name plates.

Tenderers are invited to submit their own designs and specifications, including illuminated signs.

M. PETERSON, Secretary.
Board of Control Office,
Winnipeg, May 5th, 1914. 19-20

TOWN OF SUDBURY
Province of Ontario

Pavements and Curbing

Sealed tenders will be received by the Town Clerk until 6 p.m., **Monday, May 18th, 1914**, for the laying of approximately 35,000 square yards of pavements, on concrete base. Also for the construction of 5,000 lineal yards of concrete curbing.

Offers will be considered for vitrified block, bitulithic, asphaltic concrete and asphaltic block.

Specifications, plans, profiles, etc., may be seen at the Town Hall, Sudbury, after May 9th. Additional information may be obtained at the Engineers' Office, Mail Building, Toronto.

L. O. O'CONNOR, Esq., Mayor.
W. J. ROSS, Esq., Town Clerk.
CHIPMAN & POWER, Engineers. 19

To Contractors

Sealed tenders marked "Tenders for Government House," addressed to the undersigned, will be received at this Department up to noon of **Tuesday, May 25th**, for the interior finishing of the main building of the Government House, Rosedale, Toronto, including carpentry and joiner work, plastering, painting and glazing, marble work and bronze work. Plans and specifications can be seen at this Department. An accepted bank cheque, payable to the Honorable J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender and the bona fide signatures and addresses of two sureties, or the name of a Guarantee Company approved by this Department willing to provide bond for the due fulfilment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By order,
H. F. McNAUGHTEN,
Secretary Public Works Department.
Department Pubiic Works, Ottawa,
Toronto, May 8th, 1914.

Newspapers publishing this advertisement without authority will not be paid for it. 19

CITY OF REGINA

Tenders for Trenching and Laying Water Mains

Sealed tenders, marked "Laying of Water Mains," will be received by the City Commissioners, Regina, Sask., up till noon, **May 25th, 1914**, for the trenching and laying of Water Mains on certain streets in the City of Regina.

Specifications and other information may be received at the office of the undersigned.

A marked cheque covering five (5 p.c.) per cent. of the tendered amount must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

J. M. MACKAY,
18-20 Superintendent of Waterworks.

City of Regina

Sewers

Sealed tenders, marked "Tender for Sewers," and addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, **May 25th, 1914**, for the construction of storm and domestic sewers.

A copy of specifications will be furnished to intending bidders upon receipt of a marked cheque for $25.00 made payable to the City of Regina, said cheque will be returned to bidder on the receipt of a bona fide tender and the return of specifications.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The City reserves the right to divide the works into two or more contracts and to reject any or all tenders.

17-19 F. McARTHUR, City Engineer.

TOWN OF WALLACEBURG
PROVINCE OF ONTARIO

Water Works and Sewers

Sealed tenders will be received by the Town Clerk until 8 p.m., on **Tuesday, May 26th, 1914**, for the following works:—

Contract "A-1"—Laying Water Mains in Town.
Contract "A-2"—Laying Sewer Pipes.
Contract "B"—Constructing Pump House.
Contract "G"—Pumping Machinery.
Contract "I"—Laying Intake.
Contract "M"—Laying Steel Force Main.
Contract "R"—Laying River Crossing.

Plans and specifications may be seen at the Engineers Office, Mail Building, Toronto, and at the Town Clerk's Office, Wallaceburg.

No tender necessarily acepted.

T. B. DUNDAS, Esq., Mayor.
H. E. JOHNSON, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.
19

TOWN OF ST. LAMBERT

Sewers

The period for receiving tenders on storm and sanitary sewers, street gulleys and manholes advertised to be closed at 6 p.m., May 18th, 1914, will be extended to **May 26th, 1914.**

Plans may be seen and specifications and tender form may be had on application at the office of the Town Engineer on and after the 16th inst.

The Town reserves the right to divide the work into two or more contracts and reject any or all tenders.

(Signed) E. DRINKWATER,
Town Engineer.

19

Sealed Tenders Wanted

Sealed tenders will be received by David Tasker, Secretary, the Public Schools of the Town of Sandwich, Essex County, Ontario, until six o'clock p.m. on the **6th day of June, 1914,** for the general contract of an eight-room reinforced concrete public school building, except plumbing, heating and ventilating.

Tenders for plumbing, also for heating and ventilating of the same building will be received at the same place, time and date.

All proposals shall be in accordance with plans and specifications, copies of which are on file at the offices of the Architects, Edward C. Van Leyen and Edward A. Schilling, 1115-21 Union Trust Building, Detroit, Michigan.

Copies of the plans and specifications can be had by applying to the aforesaid architects and making a deposit of $20 for the care and safe return of drawings.

Tenders shall be accompanied by a certified cheque or bidding bond in the sum of of five per cent. of the amount of proposal, payable to the Public Schools of the Town of Sandwich, as a guarantee to furnish satisfactory bond and entering into contract.

The Board reserves all rights under the specifications to accept or reject any or all bids.

DAVID TASKER, Secretary.
The Public Schools of the Town of Sandwich.
19-20

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Public Building, Milton, Ont.," will be received at this office until 4.00 p.m., on **Thursday, May 28th, 1914,** for the construction of a Public Building at Milton, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Toronto, Ont., at the Post Office, Milton, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occuptions and places of residence. In the case of firms, the actual signature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, May 5, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51490 19-20

Welland County Road System

Tenders for Macadam Road

Tenders will be received by the undersigned up to 12 o'clock noon, **May 23rd, 1914,** for the construction of 34 miles of Macadam Road on the Welland County Road System.

Specifications and forms of tender may be seen at my office and also at the office of George Ross, C.E., County Engineer, Welland, Ont.

Tenders for the whole 34 miles or any section thereof will be accepted.

The lowest or any tenders not necessarily accepted.

ROBERT COOPER,
County Clerk.

18-19

Tenders Town of Welland Pavements

Tenders are invited for the construction of approximately 6,000 square yards of pavement in Vitrified Brick, Bitulithic, Sheet Asphalt, Asphaltic Concrete, or Concrete, also for 360 square yards of concrete.

Plans and specifications may be seen at the office of the Canadian Engineer, 62 Church St., Toronto, or office of Contract Record, 220 King Street West, Toronto. Plans and specifications, etc., may also be seen at office of Town Engineer, Welland, where bidding forms and all other information may be received.

Sealed tenders fully endorsed are to be deposited with the Town Clerk, Town Hall, Welland, not later than 4 p.m. on **Thursday, May 28th, 1914.**

An accepted bank cheque valued at 10 per cent. of tender price must accompany each bid.

The Council do not bind themselves to accept the lowest or any tender.

D. T. BLACK, Town Engineer.

Engineering Department,
Welland, May 8th, 1914. 19-20

Town of Kamsack

Province of Saskatchewan

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 2 p.m.,

WEDNESDAY, MAY 20TH,

For the following works:

Contract "B"—Power House and Filter House.
Contract "F"—Furnishing and installing Pressure Filters.
Contract "G"—Furnishing and Installing Pumping Machinery.
Contract "H"—Furnishing and erecting Boilers.
Contract "J"—Furnishing and erecting Steam Engine.
Contract "K"—Furnishing and erecting Generator.
Contract "T"—Construction of Concrete Walk.

ALTERNATIVE bids will be received for Gas Producers and Engines in place of Boilers and Steam Engine of same capacity.

Plans and specifications may be seen at the office of the Engineers, Toronto and Winnipeg, and at the Town Hall, Kamsack

No tender necessarily accepted.

E. J. JOHNSON, Esq., Mayor,
Kamsack, Saskatchewan

A. A. CRAWFORD, Esq., Sec.-Treas.,
Kamsack, Saskatchewan.

CHIPMAN & POWER, Engineers,
Toronto and Winnipeg.

19

Tenders for Steelwork

Sealed tenders addressed to J. B. Cote, Secretary, and marked "Tenders for Provencher Bridge," will be received up to 12 o'clock noon, **Saturday, the 20th day of June,** for supply and erection of the superstructure for the Provencher Avenue Bridge over the Red River between St. Boniface and Winnipeg.

Plans and specifications may be seen and forms of tender obtained at the offices of:—

The City Engineer, St. Boniface, Man.
The City Engineer, Winnipeg, Man.
Contract Record, Toronto, Ont.
Pittsburg Testing Laboratories, Pittsburg.
Engineering News, New York.
Strauss Bascule Bridge Co., Chicago.

All tenders to be accompanied by a marked cheque or bid bond for $10,000.

The lowest or any tender not necessarily accepted.

J. B. COTE, Secretary,
City Hall, St. Boniface, Man.

19-23

City of Regina

Pavements

Sealed tenders, marked "Tender for Pavements" and addressed to the City Commissioners, Regina, Sask., will be received up until 12 o'clock noon, **June 1st, 1914,** for the construction of 113,000 square yards of pavement.

A copy of specifications will be furnished to intending bidders upon receipt of a marked cheque for $25.00 made payable to the City of Regina, said cheque will be returned to bidder on the receipt of a bona fide tender and the return of specifications.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The city reserves the right to divide the works into two or more contracts and to reject any or all tenders.

17-19 F. McARTHUR, City Engineer

MEDICINE HAT, ALBERTA

Tenders for the General Contract of the New Technical High School

Sealed tenders addressed to James L. MacCallum, Secretary of the Medicine Hat School Board, and endorsed "Tenders for the General Contract of the Technical High School," will be received up to 5 o'clock p.m., **June 1st, 1914.** Full particulars may be had at the office of McCoy & Levine Engineering Company, Huckvale Bldg., Medicine Hat.

An accepted cheque made payable to McCoy & Levine for the sum of ten dollars ($10.00) will be required from each contractor taking out plans and specifications on this work as a guarantee that they will put in a bona fide tender and return plans and specifications.

Each tender must be accompanied by an accepted cheque payable at par Medicine Hat, to the Medicine Hat School Board to the amount of two (2) per cent. of the tender.

Should the contract be awarded, the successful bidder shall be required to execute a guarantee bond on an approved surety company to the amount of twenty (20) per cent. of his tender as a guarantee for the faithful fulfillment of his contract.

The Cheques of the unsuccessful bidders will be returned within six days after the contract is awarded.

The right is reserved to reect any or all bids or to waive any defects.

The lowest or any other proposal not necessarily accepted.

McCoy & Levine Engineering Co.

Dated at Medicine Hat,
This 24th day of April 1914. 17-18-19

CITY OF BRANTFORD
PROVINCE OF ONTARIO

Notice to Contractors

Date for receiving tenders for Fireproof Pump House and Pumping Machinery, being contracts "B" and "G," as advertised in Contract Record in issues April 8 and 15, has been extended to May 15 1914

Tenders for Cement Walks

CITY OF SAULT STE. MARIE
Ontario

Sealed tenders, fully endorsed and marked "Tender for Cement Walks," addressed to T. E. Simpson, Mayor, Sault Ste. Marie, Ont., will be received by the City Clerk up to five o'clock p.m. on **Thursday, May 28th, 1914,** for the construction of about 84,000 square feet of cement concrete sidewalks.

Specifications and plans may be seen and all information and forms of tender obtained at the office of the City Engineer, Sault Ste. Marie, Ontario.

A marked cheque for $1,200 payable to the order of the City Treasurer, must accompany each tender. A bond to the amount of $4,000 or in lieu thereof, a cash deposit of $2,500, will be required of the successful bidder.

The lowest or any tender not necessarily accepted.

18-19 C. J. PIM, City Clerk.

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Drill Hall, Listowel, Ont.," will be received at this office until 4 p.m., on **Monday, June 1st, 1914,** for the construction of the aforesaid building.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the caretaker of Post Office, Listowel, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occuptions and places of residence. In the case of firms, the actual signature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works.
Ottawa, May 6, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—60102. 19-20

TOWN OF THOROLD
Province of Ontario

Tenders for Pavements

Marked tenders for pavements, addressed to the Town Clerk, will be received until 8 p.m., **Wednesday, May 15th, 1914,** for the construction of 6,600 square yards of pavement on Pine and Mill Streets in the Town of Thorold.

Plans and specifications may be seen at the office of the Engineers, Mail Building, Toronto, and at the Town Hall, Thorold.

Marked cheque for $1,500 required.

The lowest or any tender not necessarily accepted.

JOS. BATTLE, Esq., Mayor.
D. J. C. MUNRO, Esq.,
Town Clerk,
CHIPMAN & POWER, Engineers.
19

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by Freeman Campbell, Esq., Chairman of Committee, Randall P.O., Ont., up to noon of **Tuesday, May 26th, 1914,** for the construction of concrete abutments (containing about 100 cu. yds. concrete) for concrete truss bridge on the townline, Con. XIII., between Tecumseth and W. Guillimbury, Simcoe County, over a branch of the Nottawasaga River, about two miles south of Cookstown, known as Draper Bridge.

Plans and specifications are on file with Freeman Campbell, Esq., Chairman of Committee at Randall, Ont., at the office of R. H. Jupp, County Engineer, Orillia, Ont., and at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Consulting Engineer.
Toronto, May 11, 1914.

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Public Building, Norwich, Ontario, will be received at this office until 4 p.m., on **Thursday, May 28, 1914,** for the construction of the building mentioned.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., The Postmaster, Norwich, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occuptions and places of residence. In the case of firms, the actual signature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works.
Ottawa, May 5, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—60099. 19-30

Tenders for School

Sealed tenders will be received by the undersigned up to **May 27, 1914,** for the erection of an 8-roomed school building in the village of Paisley.

Plans and specifications may be seen at the office of Jas. L. Russell, architect, Stratford, The Contract Record & Engineering Review, 220 King Street West, Toronto, or at the office of the undersigned at Paisley.

Lowest or any tender not necessarily accepted.

W. R. BARNETT,
Secretary of the School Board,
18-20 Paisley, Ont.

Tenders
for
24 Million Gallon Centrifugal Pumps and Engines

EXTENSION OF TIME

Notice is hereby given that the date for receiving tenders on the 24-Million Gallon Centrifugal Pumps and Engines has been extended from Tuesday, May 19th, 1914, until **Tuesday, June 16th, 1914.**

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
May 7th, 1914. 19

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Drill Hall, Barrie, Ont.," will be received at this office until 4 p.m. on **Wednesday, May 27, 1914,** for the con construction of the aforesaid building.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., on application to the Caretaker, of the Post Office, Barrie, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occuptions and places of residence. In the case of firms, the actual signature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order the Honourable the Minister of Public Works, equal to ten per cent (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works.
Ottawa, May 4, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—60712.

To Contractors

[illegible] signed, will be received up to noon of **Saturday, May 23rd, 1914**, for all trades required in the erection of a residence at "Brantwood Survey," Oakville, Ont.

The lowest or any bid not necessarily accepted.

F. S. BAKER, Architect.
Royal Bank Building, Toronto. 19-20

To Contractors

Tenders will be received until **Friday, May 22nd**, for the erection of a six-storey warehouse on Wellington Street West, Toronto, for Wm. Croft & Sons, Limited. Plans and specifications may be seen at the office of C. J. Gibson, architect, [illegible] Street, Toronto. 19

Pavement Tenders

Tenders will be received to **May 20, 1914**, for the construction of 44,000 sq. yds. of pavements in the city of Fort William, Ont.

Specifications and form of tender on application. Plans may be seen at the office of the City Engineer.

The lowest or any tender not necessarily accepted.

CITY ENGINEER,
19 Fort William, Ont

Street Commissioner

Applications for the position of Street Commissioner for the City of Hamilton, addressed to John Allan, Esq., Mayor, Chairman of the Board of Control, will be received by the undersigned up to 5 o'clock on **Monday, May 18th, 1914.**

Applicants must be experienced in pavement maintenance, road-oiling, street flushing and quarry and asphalt plant management.

Applicants to state experience, reference and salary expected.

S. H. KENT, City Clerk.
[illegible] 1914 19

Positions Wanted

First Class Steel Inspector wants re-engagement by June 1st as inspector or foreman of structural steel. Advertiser, 21 Sullivan Street, Toronto. 17-19

[illegible] tions, concrete piles, desires good position with [illegible] 18-19

Agents Wanted

Large British firm manufacturing water level indicators and other municipal engineering equipment, wants representatives in Eastern Canada, Middle West and Far West. Apply Box 10, Contract Record & Engineering Review, Toronto. 16-19

Sales Agents

Large United States firm manufacturing concrete chutes, screens, car movers and other engineering and contracting specialties wants representatives in Canada. Write advising what section you can cover, to Box 22, Contract Record & Engineering Review, Toronto. 19-21

Form Clamps

We are the largest United States manufacturers of form clamps for concrete work, and desire to secure sales agents in various parts of Canada. Our clamps are used by the best construction companies on the Continent. Apply Box 23, Contract Record & Engineering Review, Toronto. 19-20

Business Opportunity

For Sale—Woodworking shop fitted especially for general work such as interior trim, doors, sash, etc. New and up-to-date machinery. First class dry-kiln. Blower system. Railway siding. Situated in a thriving Ontario town. Splendid local and shipping trade.

This is an exceptional chance to buy a bright business with a trade already established.

Write to J. A. C., care Contract Record, Toronto. 19-20

Business Notes

Ancienne Lorette, Que.

A fire at the sawmill of Hamel Allard resulted in a loss of $6,000 which was covered by insurance. The premises will be rebuilt and new machinery will be required.

Des Chaillons, Que.

The firm of J. J. Beaudet & Cie, brick manufacturers, has been registered.

Quebec, Que. (Limoilou)

The box factory of the Turner Lumber & Pulp Wood Co. has been destroyed by fire. The loss, which was covered by insurance, is estimated at [illegible]. The factory will be rebuilt.

STEEL & RADIATION LIMITED
Products all Made in Canada

Toronto, Ont. **Fenestra** SOLID STEEL WINDOWS Montreal, Que.

Steelcrete Concrete Reinforcing
Steelcrete Metal Lath
Steelcrete Steel Lockers

FOR SALE
"TAMCO" Crushed Stone in all sizes, for all purposes.
"Roman" building stone.
"Milton" pressed bricks.
Sanitary flooring, stone crushers, fire engines, &c.
T. A. MORRISON & CO.
204 St. James Street,
Tel. Main 4532. Montreal.

TRADE MARK TAMCO

Arthur L. Weeks
Architect
Canada Life Building, Ottawa

Reinforced concrete and steel structures, factories and commercial buildings

---

R. CAMPBELL
Cold Storage Builder and Engineer
631 Bathurst Street, - Toronto
Phone College 1416

Contractor for Cold Storage Buildings, Abbatoirs, Creameries and similar structures where the insulation or waterproofing requirements call for special attention.

IAPHRAGM PUMPS
WITH IMPROVED VALVES
(Patented)

Unequalled for pumping large quantities of water by hand power, and for raising sewage sludge and all kinds of semi fluids generally. In many sizes and types. Capacities from [illegible] to [illegible] gallons an hour. Workable by hand and mechanical power.

Fully Illustrated Price List mailed free on request to—

HONIG & MOCK, Ltd.
7, MARK LANE, LONDON
ENGLAND.
"The Pump for Emergencies"

Second Hand Plant and Equipment at Attractive Prices
(Just Overhauled and in First Class Order)

Electric Motors, 5 to 300 h.p.
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
Valves and Fittings

[illegible]
Blacksmith Outfits
[illegible]
[illegible]
[illegible]
Winches.
Air Compressors.
[illegible]
[illegible]

[illegible]
Drill Steel—Octagon, Cruciform and [illegible] Round.
[illegible]
[illegible]
[illegible]
and a large and varied assortment [illegible]

[illegible]

[illegible]

The above list is necessarily condensed. Whatever you want in the line of general contractor's equipment [illegible]

Address all enquiries to
W. H. [illegible]
[illegible]
B. C. Electric Block, Vancouver, B.C.

Why waste time placing your building supply orders in half a dozen places?

SMYTH and RYAN

can supply you with everything that goes into your building except the iron and lumber

Just One Phone Call and Your Worry is Over

You can rely absolutely on prompt delivery of high grade materials at standard prices.

Exclusive Toronto Agents for

National Fire Proofing Products

Toronto Agents for

OWEN SOUND CRUSHED STONE

Deliveries, G. T. R. and C. P. R.

Sand and Gravel by Team or by Car Load

We also carry in stock trap rock in all sizes.

Head Office: 1327 Bloor West, Phones Junction 828 and 829
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Because of its deep uniform and rich red color Hamilton Pressed Brick has been selected for many of the leading buildings in Canada.

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MOTOR CRABS
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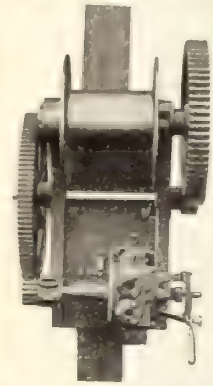

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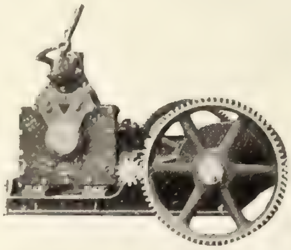

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in Sawn Slabs

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Sole Manufacturers under Canadian and U. S. Letters Patent
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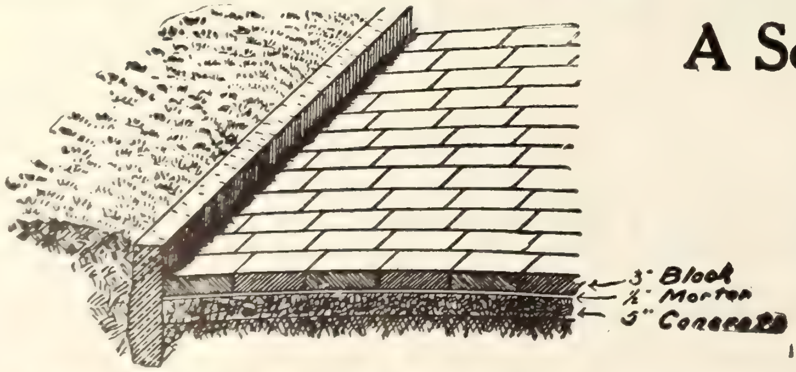

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up to 12 inches diameter

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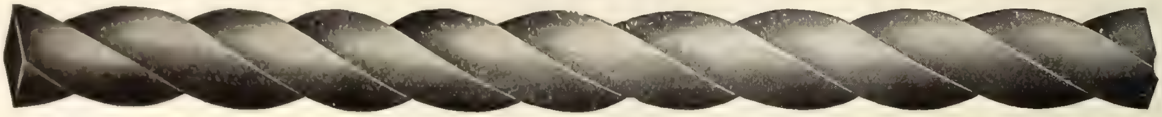

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Bell and **Spigot** Joints, caulked with lead and yarn.

All pipes asphalt coated and wrapped **spirally** with specially tested Jute.

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"Industry" Steel Pipes afford absolute protection against breakage. Buy pipe by the foot, not by the ton—and save from $500 to $5,000 per mile, depending on the size.

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One of the largest steel plants in Germany, employing 50,000 men. The entire process of manufacture, from the mining of the ore to the finished product is controlled by one organization.

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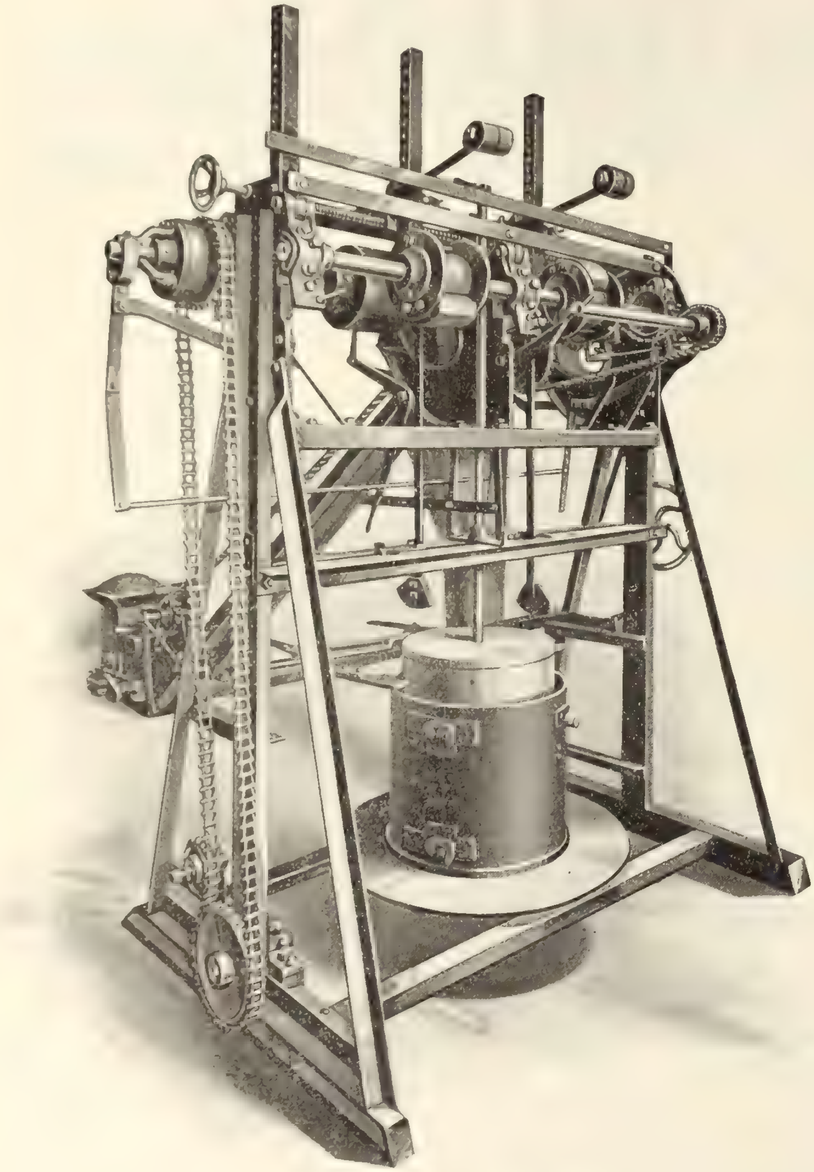
Concrete Machinery



The Besser Large Power Tamp Cement Tile Machine

The introduction of this machine eliminated the hand labor previously employed in the manufacture of large size cement tiles. Concrete drains and sewers are now being laid in all parts of the country, and the machine illustrated opens up a business of great magnitude and profit, in supplying the increased demand for tile of large dimensions. The Besser Machine makes cement tile from 8 to 48 inches in diameter and 24 to 38 inches in length, with plain end, bell end, or socket joint.

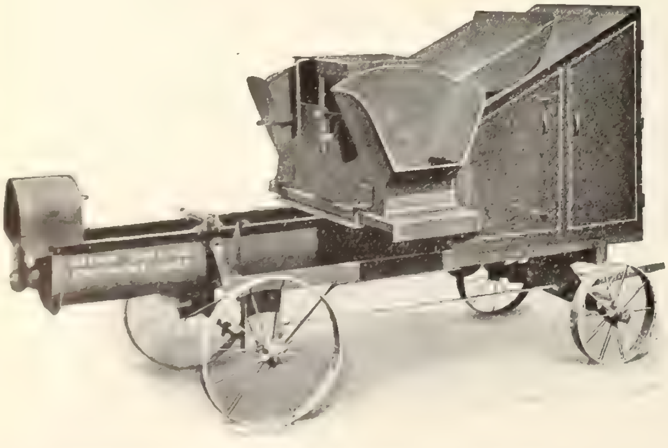
Its main advantages are:—Saves the man at the elevator; wonderfully simple and effective; has no cranks, chains, or sprockets; cuts out hand work; gives bigger profits; has large capacity.

The superiority of cement drain and sewer tile is beyond dispute. There is no better machine on the market for its manufacture than the Besser.

The advantage of the Besser Mixer over any other machine of this type lies in its simplicity of construction and economy of operation. It has not a single chain, sprocket or gear to cause a breakdown and the regular expense.

All operations are automatic and continuous—measuring, proportioning, mixing, wetting and discharging.

The Besser Simplifed Continuous Mixer



The simplicity of the Besser Mixer cannot be over valued, eliminating as it does the delays and expenses accompanying the maze of gears, chains, bearings, etc., usual to concrete mixers. We have catalogues dealing individually with our Concrete Machines—let us know the particular type you desire and we will forward you the necessary information.

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"American" Enameled Brick

**Sanitary, Fireproof
Light Reflecting and
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and all acids except hydrofluoric

Manufactured "exclusively" for over twenty years by a factory designed to produce only the highest standard of Enameled Brick.

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Look over this list—it will save you many dollars.

NET PRICE LIST PER FOOT

Rubber Belting

Width Inch	4 ply	5 ply	6 ply
4	16	20	
5	20	25	
6	25	30	35
8	31	36	40
10	40	47	55
12	50	60	70
14	55	70	80
16		80	90

Stitched Canvas Belting

Width Inch	4 ply	6 ply
4	13	18
5	17	23
6	20	27
8	25	36
10	32	45
12	37	55
14	45	69
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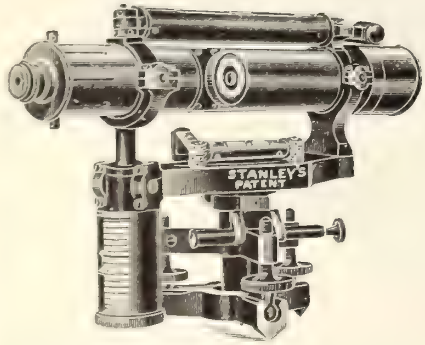

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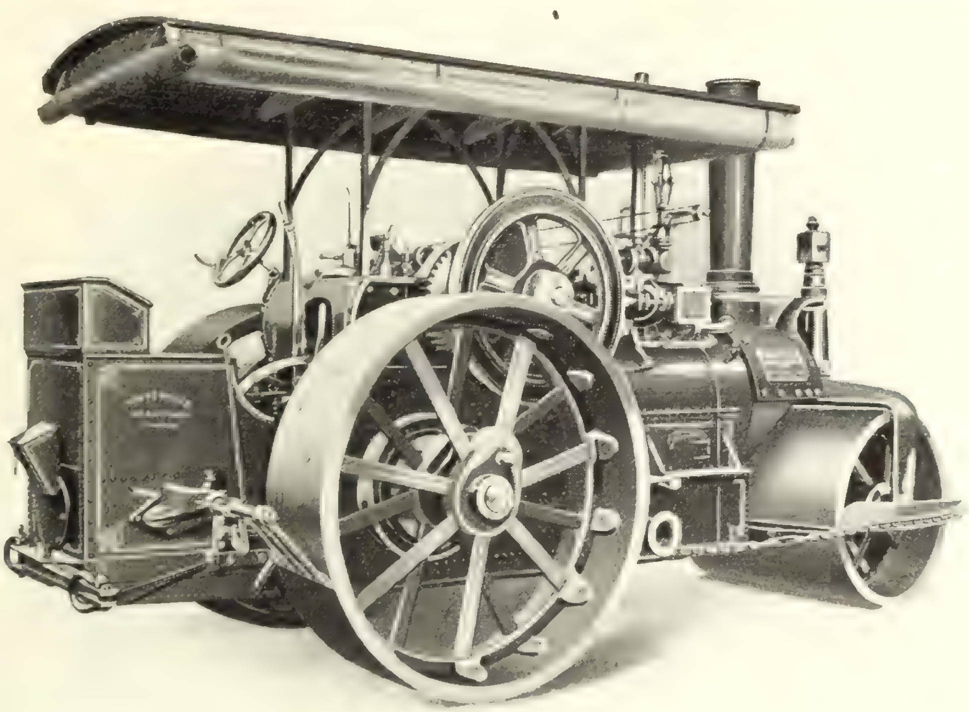

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The Waterous Steam Roller

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¶ It has built more miles of Canada's good roads than all other makes combined.

¶ It has built the finest roads in the Dominion.

¶ 165 users—the leading municipal and contracting road builders in all parts of Canada are proving the worth of the Waterous Roller on every kind of road work. Their unanimous endorsement of the machine as an efficient road builder and as a big factor in keeping down costs is significant.

When you use a Waterous, you use a Roller that has a reputation for doing good work. This reputation backs up your bid in that it acts as a guarantee that your work, when finished, will be right.

And what is more—the use of the Roller assures you of a profit on your contract even when you are working on a rock bottom price.

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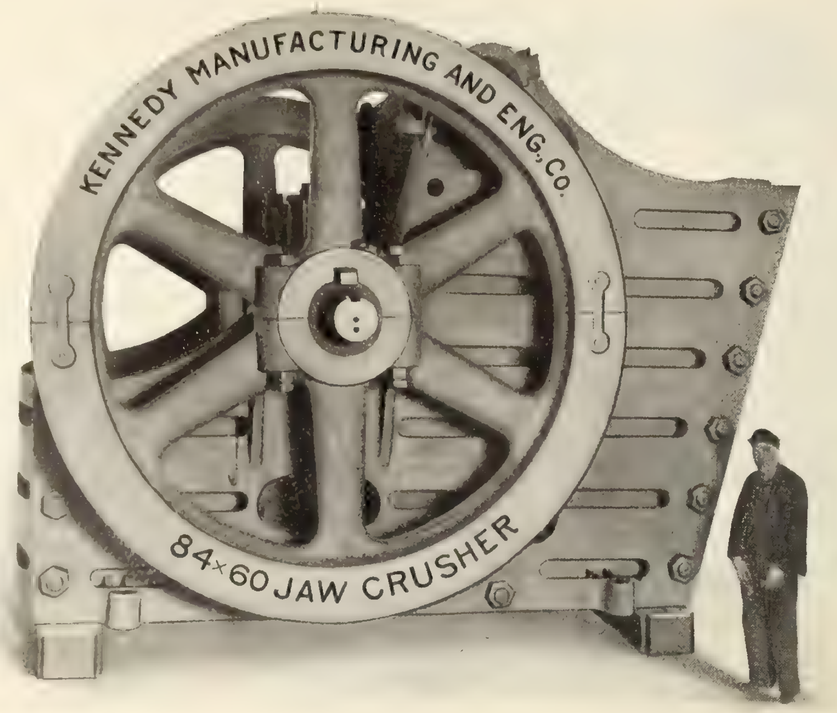
Hugh Cameron & Company, Manning Chambers, Toronto, Ont.



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RUNNING MATE TO THE GREAT 42 GYRATORY.

The above cut represents the Kennedy, balanced, steel frame, Jaw Crusher, made in sizes with openings from 7 x 10 to 84 x 60. By the substitution of steel frames for cast iron we make the machine 50% lighter and maintain 50% greater strength. With the balanced Jaw Crusher we cut down the power approximately 50%. Our Jaw Plates are corrugated on both sides and the angle of the stationery and movable Jaw is such that the Jaw plates are interchangeable from one Jaw holder to the other, reversible end for end and side for side, thus insuring at least 100% more wear out of the Jaw plates than can be procured from any other machine.

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A12
PAGE 1

IT RUNS ON BALL-BEARINGS—IT SURE DOES RUN.

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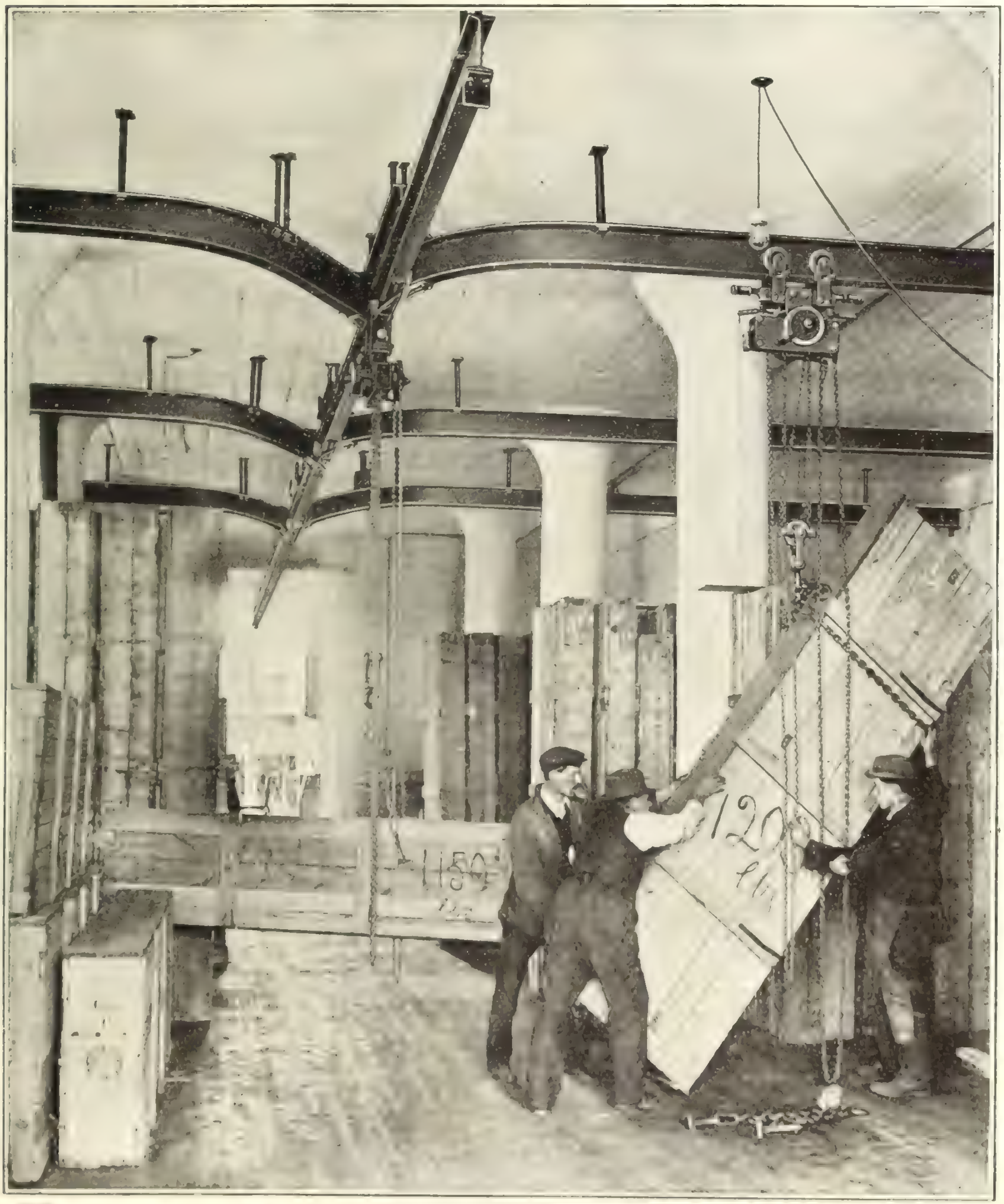

B143

This picture shows how the Calgary Paint & Glass Company, Limited, handles cases of glass in its new warehouse. A Morris Runway that carries big sheets of glass without shaking or breaking, picking them right off the dray and taking them direct to any point in the warehouse without stop, hesitation or trouble. Does that mean anything to you?

Save time. It's the easiest way to make money.

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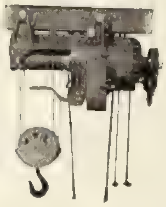

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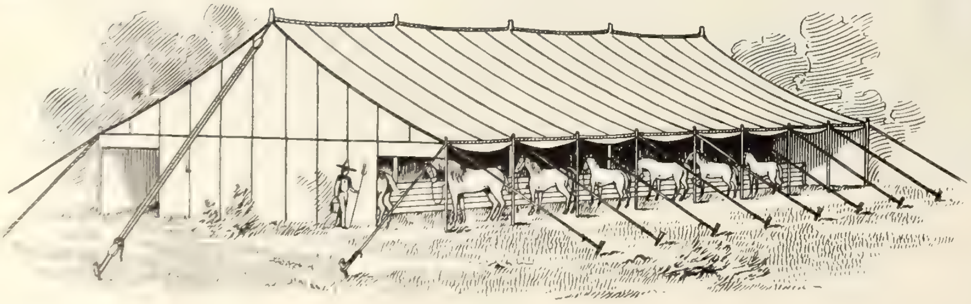

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Horse covers, wagon covers, feed bags, wood or iron blocks of every description.

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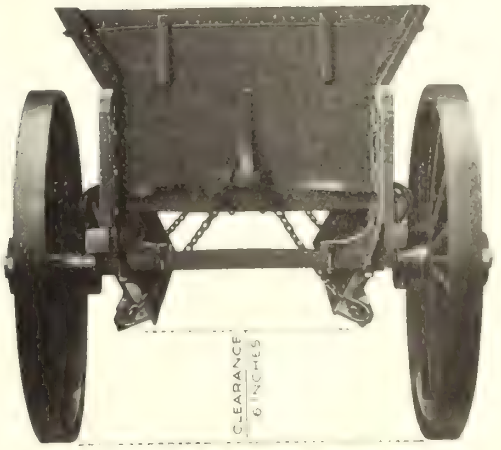

in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

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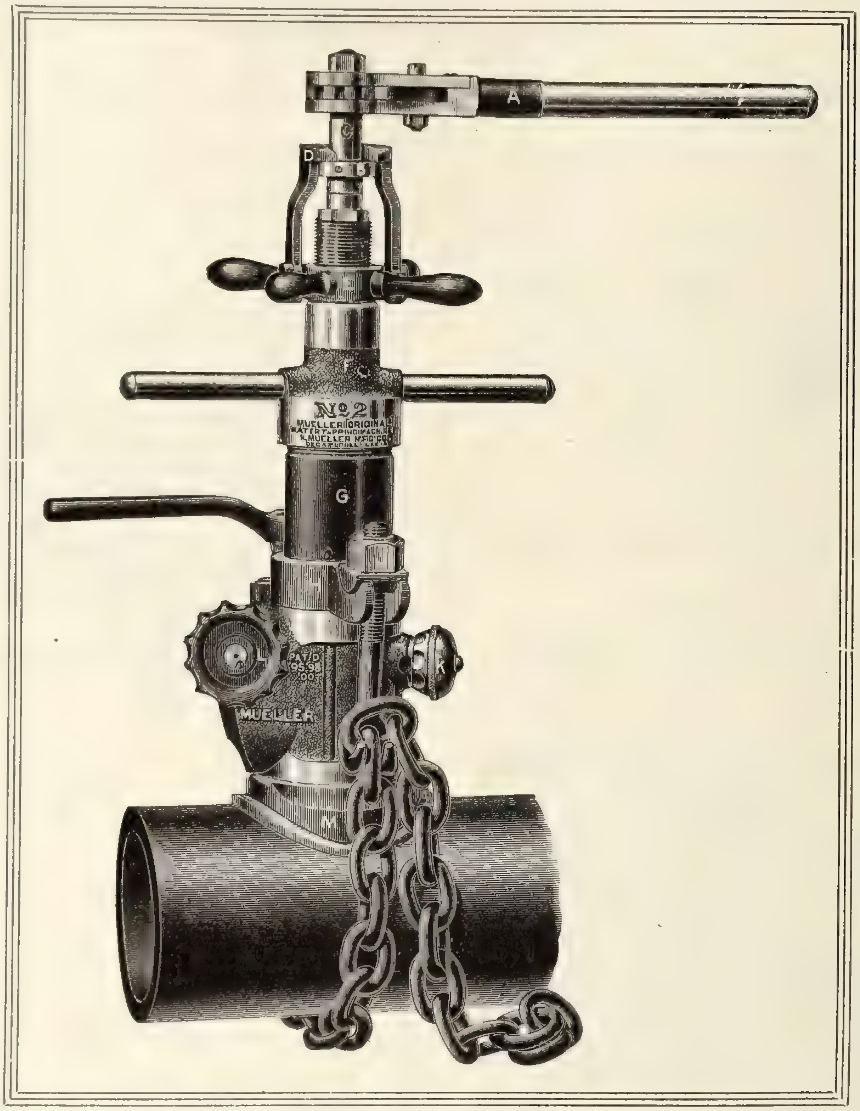
Taps water mains and inserts corporation cocks 3/8" to 1" inch under pressure



This machine has an unsurpassed record for service—30 years or more. There is practically no wear out to it. It is a strong and solid machine but one man can easily handle it. Taps can be made from any angle.

With this machine Corporation Cocks may be inserted in mains or withdrawn from mains and replaced with a plug. It is not necessary to shut off the water.

The most complete machine of the kind ever offered the water works trade. Ask us for complete description and prices.

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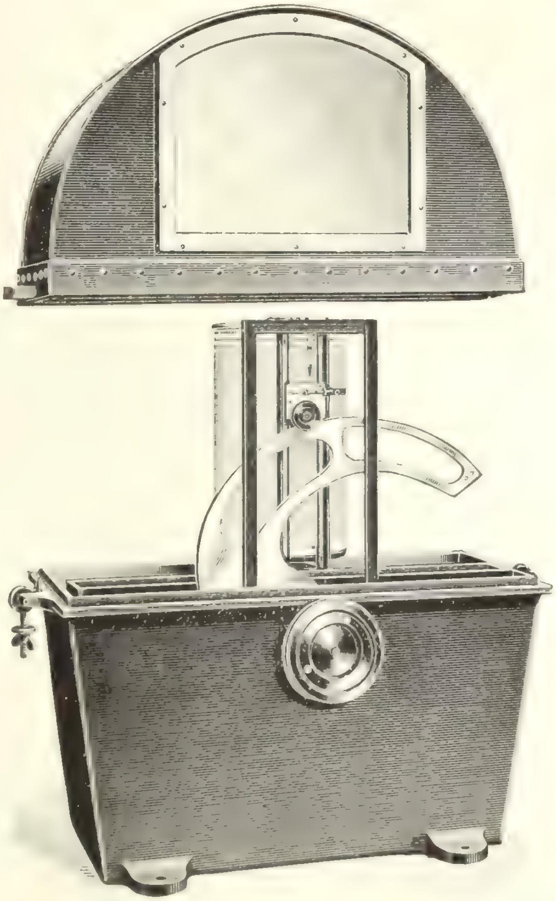
Makers of High Grade Water, Plumbing and Gas Brass Goods



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The most modern plant in Ontario, plus unsurpassed manufacturing facilities and the use of the best raw materials are the forces governing the output of our concrete products. Our manufactures include building blocks, silo blocks, concrete fence posts, railroad pipes, and culvert and sewer pipes.

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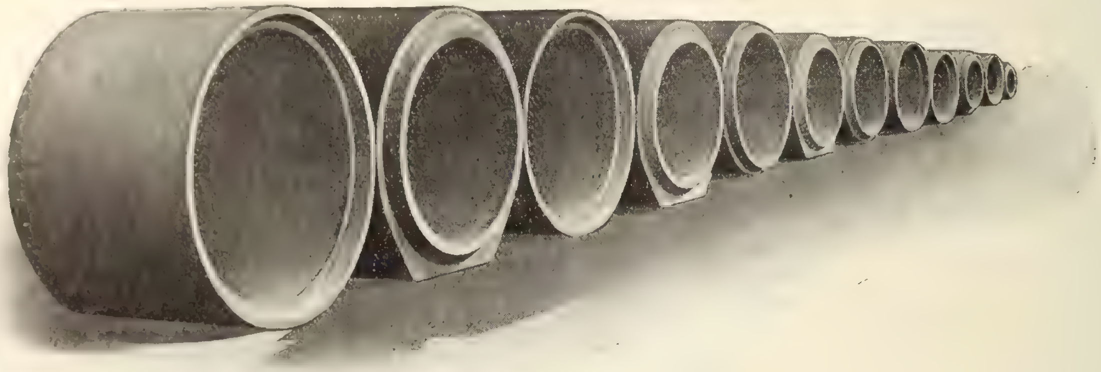
Your enquiries are respectfully solicited, and will receive prompt attention.



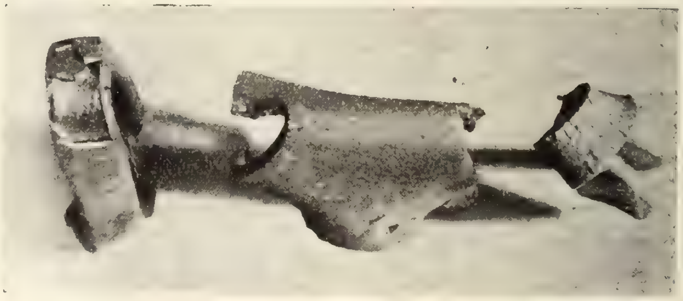
National Concrete Mfg. Company, Limited

LINDSAY, ONTARIO

The evidence of the overwhelming superiority of the new Sherardized Coating on

Herringbone Metal Lath

does not depend on the statement of any interested party.



A B C

Effect of bending on Galvanized Coatings, magnified six diameters.

A Hot Galvanized Coating.
B Sherardized alloy, zinc dust removed.
C Electro galvanized coating.

Note ability of Sherardized coating to withstand bending.

Read the extract from the report of Prof. Burgess, Metallurgist, of the University of Wisconsin:

"In a series of tests it was shown that 0.1 gram of Sherardized coating material from an iron article, dissolved in a normal sulphuric acid in 304 minutes. Zinc from an electro galvanized coating dissolved in 50 minutes. Powdered zinc from a hot process bath dissolved in 20 minutes."

Why specify Herringbone Sherardized Lath "or equal." There is no equal, and the price of the Sherardized coating competes with the cheapest galvanizing.

Clarence W. Noble, *General Sales Agent*

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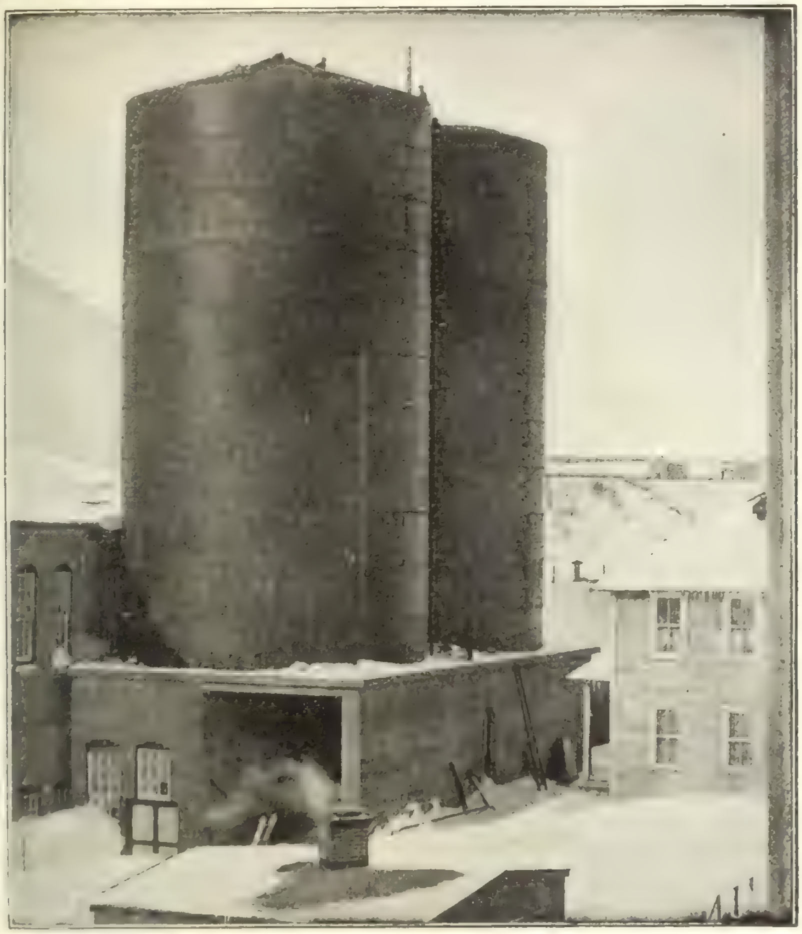
The Metal Shingle & Siding Company, Manufacturers



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Municipal Filtration and Water Softening Plants

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We GUARANTEE
Results under all
Conditions

Write us for our "Red Book" on Water Softening and Purifying

Messrs. The Paterson Engineering Co.

Canadian Agents:

LAURIE & LAMB

Board of Trade Building, MONTREAL

Luxfer Prisms

TO get daylight into dark offices, warehouses and factory buildings use Luxfer Prisms.

The results obtained by the use of accurately formed Luxfer Prisms are surprising.

We can "show you" in our laboratory just what Luxfer Prisms can do for you.

Write us.

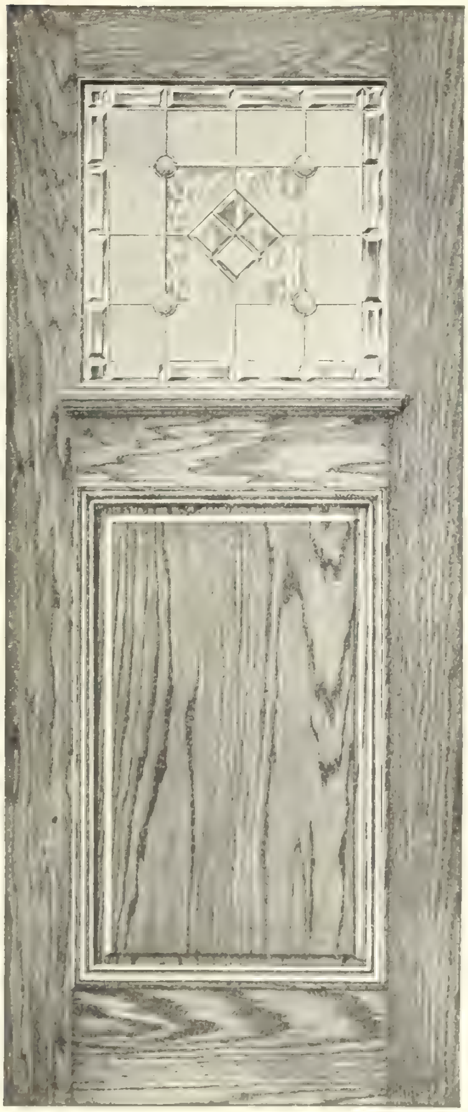
Luxfer Prism
Company, Limited
100 King St. West
Toronto

Doors

Base

Balusters

Columns

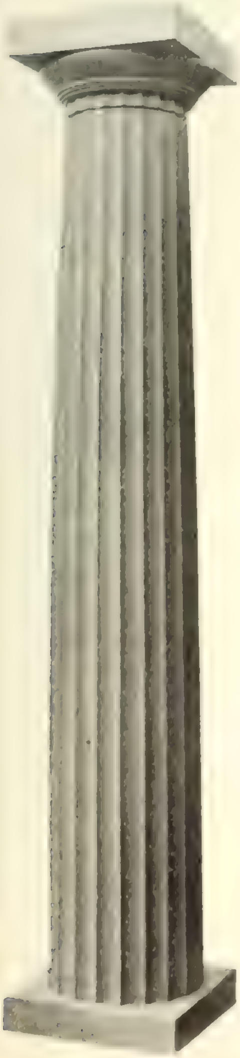


Sash

Trim

Turnings

Newels



IF you want high-class doors of good appearance and made of selected woods, we suggest Batts Limited as the place to get them. The workmanship in our doors is thorough and all woods are properly seasoned giving the doors long life.

In our columns the special "V" lock joint makes it impossible for them to crack or open.

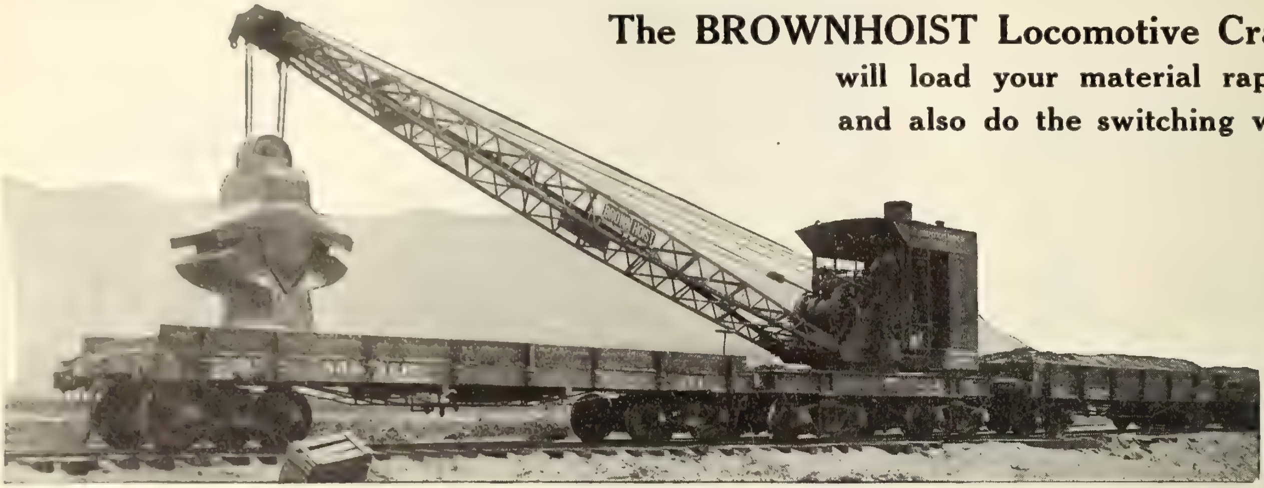
Specify "Batts" doors, columns and trim.

Batts

Limited

Pacific Ave., Toronto

The BROWNHOIST Locomotive Crane
will load your material rapidly
and also do the switching work

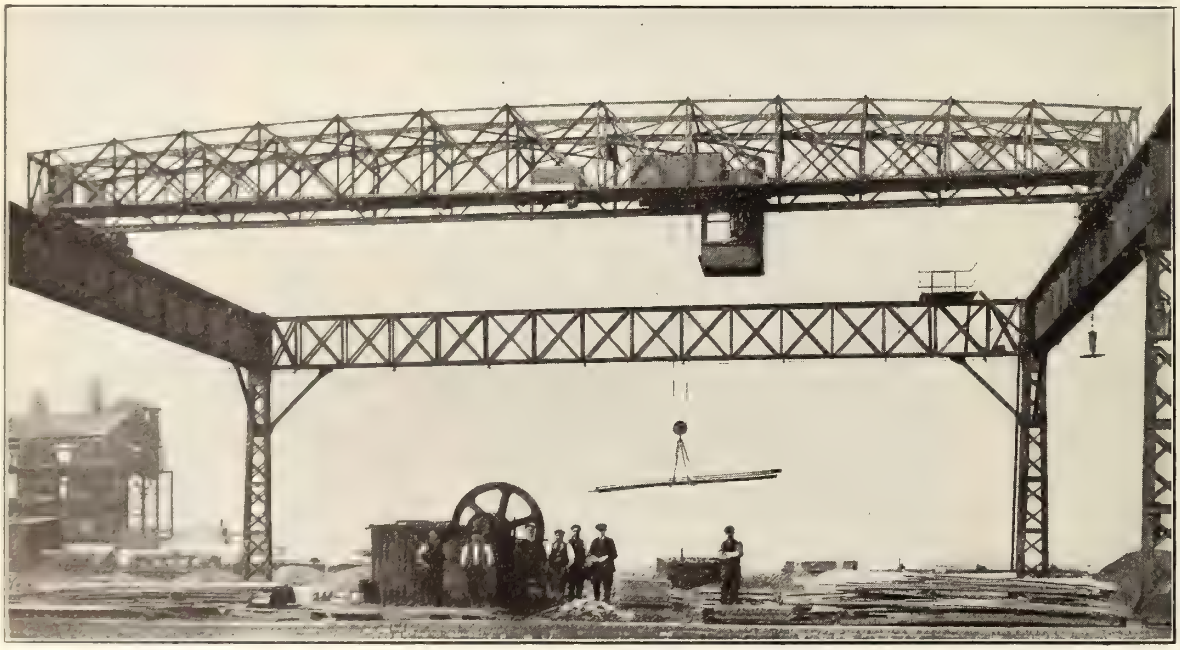


15-ton Brownhoist Locomotive Crane with Brownhoist Grab Bucket used by the Independent Stone Co., San Diego, Calif.

This crane with the Brownhoist patented grab bucket, handles ore, coal, crushed stone, sand, gravel, etc., 60 to 120 tons per hour. And one man operates the crane. Figure what a saving this would mean in your handling costs. And when you use a Brownhoist crane you are not continually troubled with breakdowns. Ask the owners—they will tell you.

CATALOG "K" SHOWS HOW AND WHERE THIS CRANE AND BUCKET ARE USED. SEND FOR IT.

THE BROWN HOISTING MACHINERY CO., CLEVELAND, O.
New York Pittsburgh Chicago San Francisco Portland, Ore., The Colby Engineering Co.



Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

Royce
Electrical Cranes Capstans Telfers Winches

Include Royce Crane Type Motors, Controllers, Over Hoisting Safeguard.

YOUR ENQUIRIES ARE SOLICITED FOR

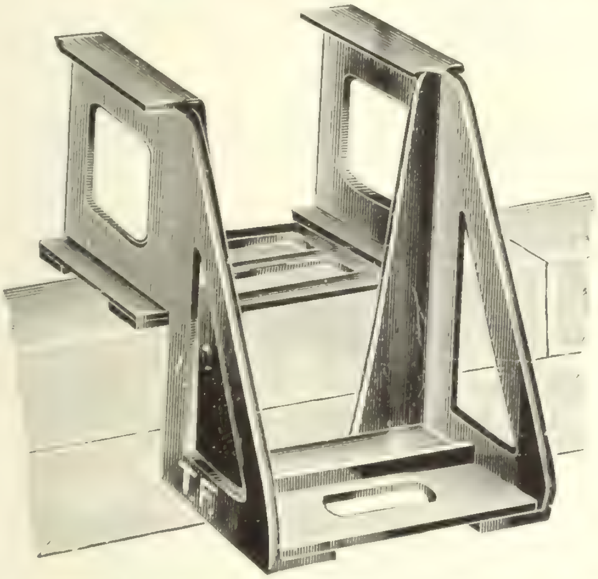
CRANES TELFERS CAPSTANS WINCHES

ROYCE, LTD., Trafford Park, Manchester, England

THE HAMILTON BRIDGE WORKS COMPANY, LTD., Hamilton, Canada

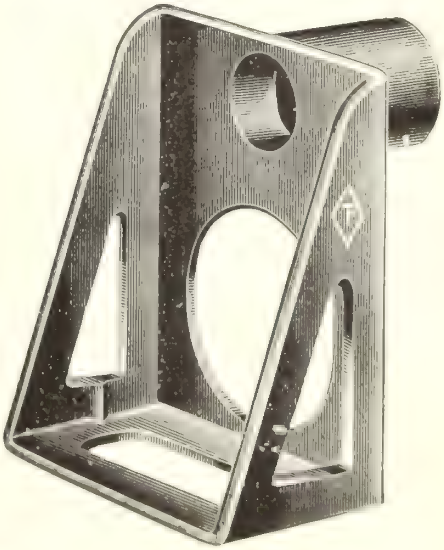
ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons
STEEL BRIDGES AND BUILDINGS

WALL AND JOIST HANGERS (MALLEABLE IRON)



Over 40 Styles and Sizes

We are the only makers of this line in Canada.



Send for Stock Sheets and Prices

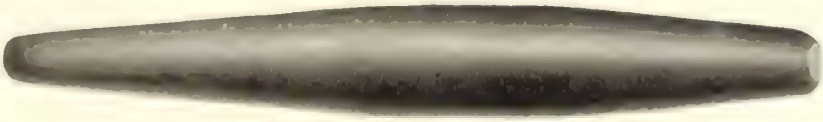
Taylor-Forbes Company Limited, GUELPH ONTARIO

1088 King St. West, Toronto and 246 Craig St. West, Montreal

H. F. MOULDEN & SON, Winnipeg
P. D. McLAREN, LIMITED, Calgary

Canadian Billings & Spencer, Limited

B
TRADE MARK



B
TRADE MARK

Drop Forged Drift Pins
fit right and wear well

Welland, Ontario

The Canadian Bridge Company Limited

Walkerville, Ont.

Manufacturers of

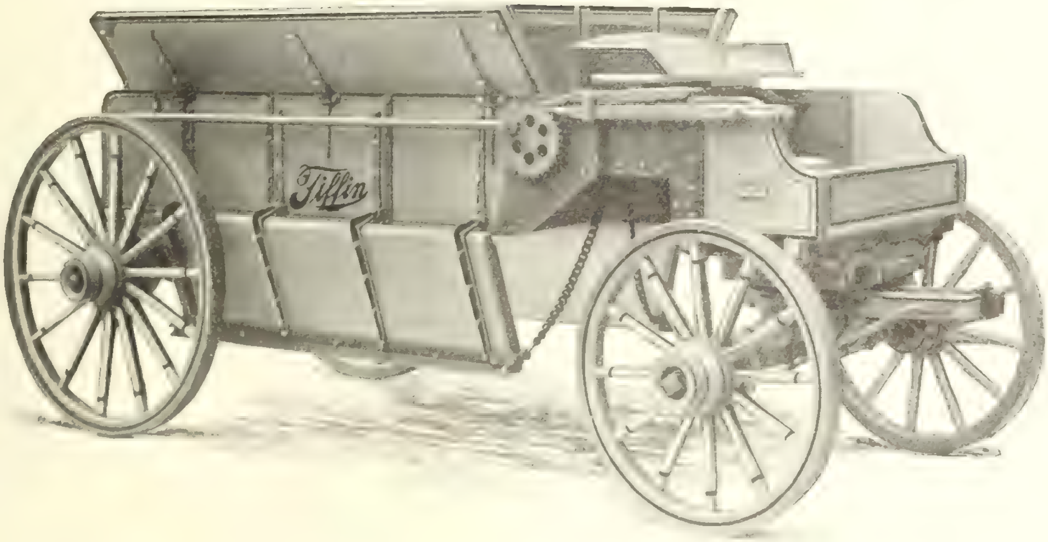
Steel Buildings
Roof Trusses
Railway and
Highway Bridges

Locomotive Turn Tables, Structural Steel and Iron Work of all kinds.

Estimates furnished on application.

Canadian Pacific Railway Locomotive Shops, near Calgary, Alberta
Steel furnished by The Canadian Bridge Company, Limited
Westinghouse, Church, Kerr & Company, Engineers and Contractors

TIFFIN



DUMP WAGONS

TIFFIN DUMPING WAGONS are **WHOLLY RIGHT.** Right in every detail from start to finish. The dumping device is strong, durable, trouble and fool proof. It always "works" according to schedule under all conditions and in all weathers. These wagons are giants of strength because built of superior materials in a superior manner.

You can parallel **some** of the advantages of **TIFFIN** Wagons in wagons of other makes, but in no other one make have been combined **so many** advantages as in the **TIFFIN**—is our honest claim.

Builders also of Tiffin Farm Wagons
Tiffin Street Sprinklers and Flushers
Tiffin Carts and Tiffin Motor Trucks

THE TIFFIN WAGON CO., TIFFIN, OHIO

AGENTS: Francis Hankin & Co., Montreal, Toronto and Vancouver
Jas. Bisset & Co., Edmonton, Alta.

Renfrew Lime

Will save you money

NOT because it is cheaper than other limes but because it has some advantages not found in other brands.

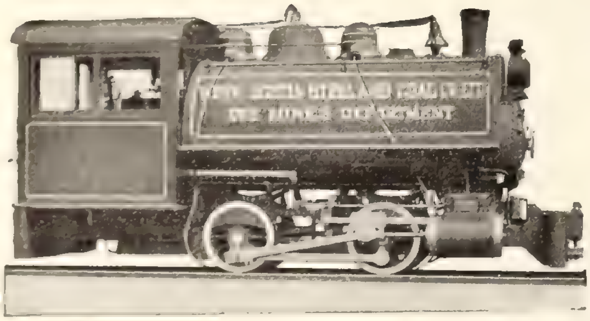
It is easily bedded down and does not set too rapidly, allowing the brick-layer to spread for more bricks. It requires but little time for tempering and sets hard as a rock.

Try "Renfrew" lime on your next job.

White Lime — Gray Lime
Stone — Drain Tile — Brick

Jamieson Lime Company
Renfrew, Ontario

Keep the Work Going



Nothing is more important in contracting work than the prompt and certain movements of cars.

Delays affect the whole job. To avoid delays and insure maximum yardage, locomotives must be reliable and always ready for service.

Our Standard Contractors' Locomotives are built to insure reliability and constant service. Only tested materials are used in their construction. All wearing parts are made to templates and gauges. Interchangeability of like parts is guaranteed, and long delays waiting for duplicate parts avoided.

MONTREAL LOCOMOTIVE WORKS, LTD.
DOMINION EXPRESS BUILDING, MONTREAL, CANADA

"SUPERIOR GRAPHITE PAINT"

—ON—

BRIDGES

MEANS

PROTECTION

ITS USE INSURES these costly structures AGAINST CORROSION

"Superior Graphite Paint" is unaffected by the weather, gases, or brine drippings.

Special Coatings Made for Salt Water Exposures

The use of "Superior Graphite Paint" and the Special Protective Bridge Coatings made by this Company has steadily increased, and their use by the leading railways and municipalities is a guarantee of their quality.

———*Write for full particulars to*———

DOMINION PAINT WORKS, LIMITED

WALKERVILLE, ONT.

Made in U. S. A. by DETROIT GRAPHITE CO., Detroit, Mich.

Montreal
Toronto

Winnipeg
Vancouver

TENDERS FOR WORK

We would be pleased to submit prices on timbers of any description for building,

Tugs Dredges Scows
Wharves Coal Shoots or Piling

It would be entirely to your advantage to have competitive prices on your requirements, and to have our prices even if only as a matter of record.

OUR MILLS RUN ALL WINTER.

JAMES SHEPPARD & SON

SOREL, QUE.

Red Freestone

THE red freestone quarried by us is of the finest texture and greatest crushing strength. Tests in the laboratory and actual service have proved Sackville Freestone to be the best building stone quarried in Canada.

Our facilities enable us to take care of the largest orders in the shortest time.

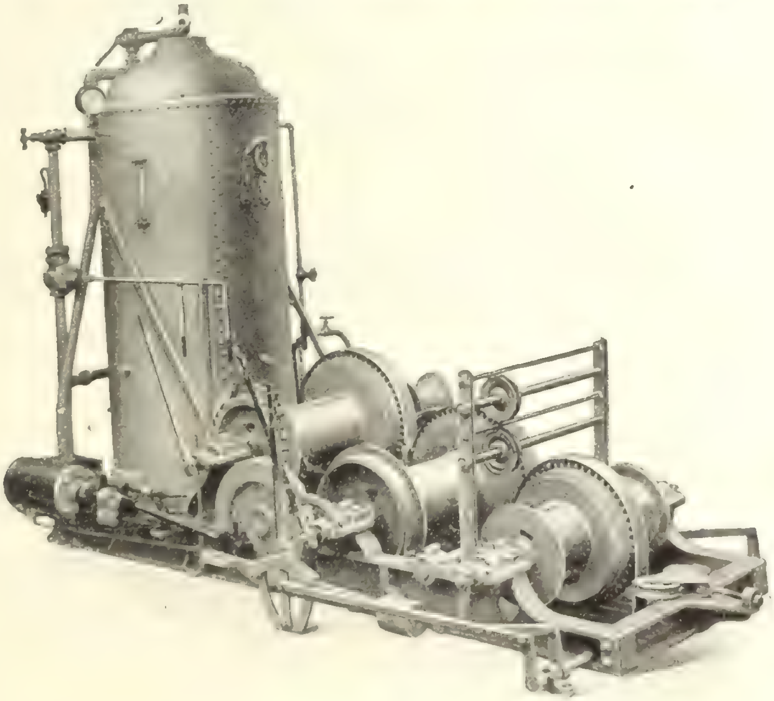
Block Stone, Dimensions, Random, Head Sills, Shoddy, Stone Sawing.

Write us for quotations

Sackville Freestone Co. Limited

Sackville, New Brunswick

BEATTY HOISTS and Material Handling Plant



STANDARD DOUBLE CYLINDER, DOUBLE FRICTION DRUM HOIST WITH NO. 2 SWINGER

The satisfactory performance of Beatty Hoists and Clamshells has been demonstrated on thousands of jobs throughout the Dominion.

If you require a Single, Double or Triple Drum Hoist of any size, let us show you what we can do in the way of construction, delivery and price.

We can meet your requirements on all three counts.

Standard size Hoists, Clamshells, Derrick Irons, etc. ready for immediate shipment.

Let us send you our new general catalogue.

TYPE "D" DREDGING CLAM

M. BEATTY & SONS, LIMITED

WELLAND, ONTARIO

AGENTS

H. E. Plant, 1790 St. James St., Montreal
Robt. Hamilton & Co., Vancouver, B. C.
H. W. Petrie, Limited, Toronto.
E. Leonard & Sons, St. John, N. B.
A. R. Williams Machinery Co., Winnipeg

Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915

Factory: 550 Pacific St., VANCOUVER, B. C.

Another Big Contract

The new plant of the Northern Aluminum Company, Toronto. The contract for roofing and sheet metal was executed by us.

We specialize in

The Built up Pitch, Felt and Gravel Roofing, Damp-proofing Foundations, Slating, etc.

We also manufacture

SKYLIGHTS, CORNICE, FIRE DOORS AND WINDOWS, TIN CLAD DOORS, ASPHALTS, TARRED AND DRY FELTS, COAL TAR PITCH

We will quote you attractive prices on any of the above—write us.

REGGIN AND SPENCE

Roofing and Sheet Metal Contractors

530 Front Street West - Toronto

Erected at Seven Falls, Quebec, Distributor Pipe and Branches, under 450 ft. Head.

Structural and Steel Plate Work

is our specialty. We fabricate and erect from your drawings, or will design your structure for you.

No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

WALSH PLATE & STRUCTURAL WORKS, LIMITED

Drummondville, Que. Holyoke, Mass.

The Maritime Bridge Company, Limited

Successors to

Wm. P. McNeil & Company, Limited

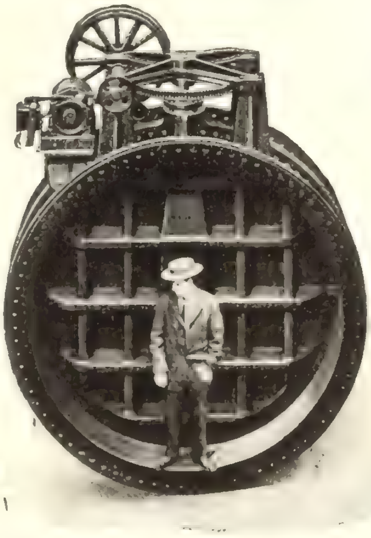
Manufacturers of

Bridges—Steel Buildings
Roof Trusses — Turntables
Towers—Girders and
Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, **New Glasgow, N. S.**



96″ Motor Operated Butterfly Valve.

- Valves
- Sluice Gates
- Fittings
- Flanges
- Castings
- Separators
- Exhaust Heads
- Expansion Joints
- Pipe Bends
- Welded Work
- Hydraulic Piping

We make a specialty of designing and executing complete piping contracts. Estimates furnished on receipt of plans and specifications.

PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION CO.
PITTSBURGH, PA.

ATWOOD ENGINEERS FOUNDERS MACHINISTS ATWOOD

James Thomson, President. J. G. Allan, Vice-President. James A. Thomson, Secretary

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

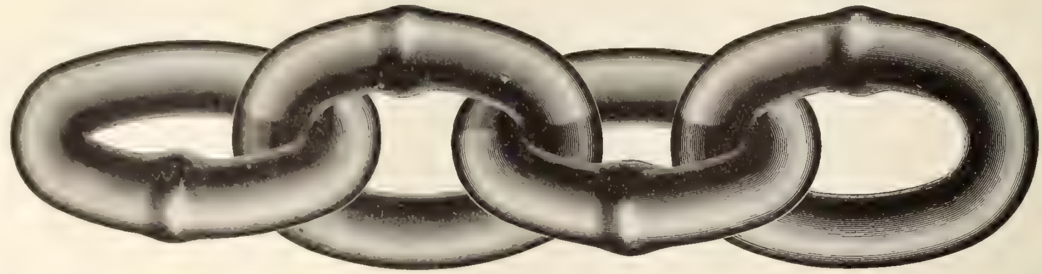
Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

HAMILTON, ONT.



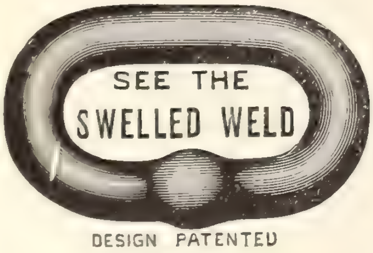
McKinnon Electric-Welded Chain

(BB Quality)

Size	Links Foot	Weight 100 Feet	Proof Test	Breaking Strength	Working Strain
1/8	11	21 lbs.	800 lbs.	1800 lbs.	500 lbs.
3/16	15	43 lbs.	1300 lbs.	3000 lbs.	900 lbs.
1/4	10½	74 lbs.	3000 lbs.	6000 lbs.	1800 lbs.
5/16	9½	106 lbs.	4500 lbs.	8500 lbs.	2500 lbs.
3/8	8½	149 lbs.	5500 lbs.	11000 lbs.	3500 lbs.
7/16	8	206 lbs.	7500 lbs.	16000 lbs.	4500 lbs.
1/2	7	265 lbs.	10000 lbs.	20000 lbs.	6000 lbs.
5/8	5⅝	390 lbs.	13000 lbs.	26000 lbs.	7500 lbs.
3/4	5	575 lbs.	18000 lbs.	36000 lbs.	10000 lbs.

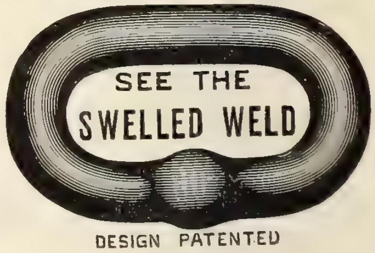
BBB Quality proof tested 15% higher than BB Quality

25% { More Weld = 25% { More Strength = 25% { More Wear



" DREADNAUGHT " STEEL LOADING CHAIN

Size	Links Foot	Weight 100 Feet	Proof Test	Breaking Strength	Working Strain
7/32	16	60 lbs.	2200 lbs.	4500 lbs.	1500 lbs.
1/4	14	80 lbs.	2500 lbs.	5000 lbs.	1750 lbs.
9/32	13	90 lbs.	3500 lbs.	7000 lbs	2000 lbs.
5/16	12	110 lbs.	4500 lbs.	9000 lbs.	3000 lbs.
3/8	10½	150 lbs.	6000 lbs.	11000 lbs.	4000 lbs.



Made
in
Canada

Sold
by
Jobbers

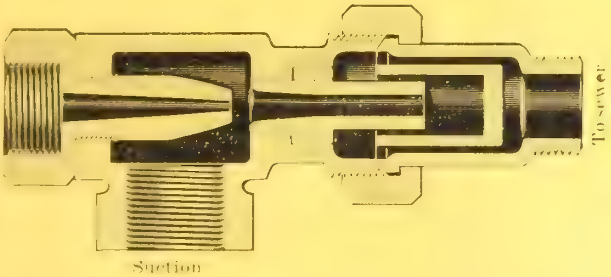
Made by

McKinnon Chain Co. St. Catharines, Ont.

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

Corporation Brass Goods

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY



MORRISON Water Jet Lifter

A water ejector that requires no priming, that operates successfully on lifts up to 30 feet. (Producing a vacuum of over 27 inches of mercury). It is operated by water from the service mains or other high pressure source and requires no labor or attention whatever.

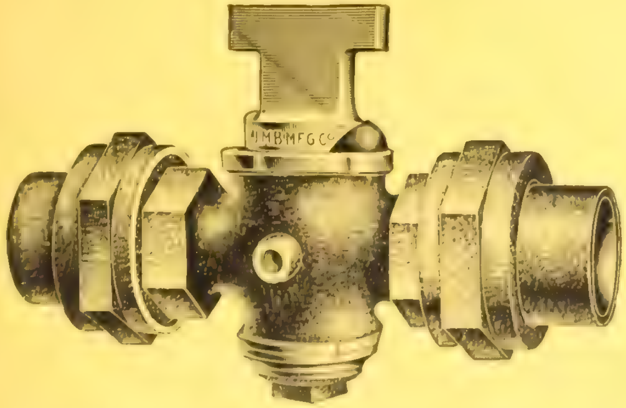
It is the most convenient machine made for draining flooded excavations, pits, basements, etc. It is fitted for pipe or hose connection, operates in any position, and has nothing to adjust or get out of order

Do you know why a very large percentage of the Corporation **Brass** Work now in use in Canada bears the Morrison Trade Mark? If you have experience of the Morrison Line you can easily find a reason. It is that we aim to do business by virtue of making each article we manufacture conform with the best known design and by careful workmanship and high grade material make each article render a maximum of service.

Our line of Corporation Brass Goods and supplies includes:

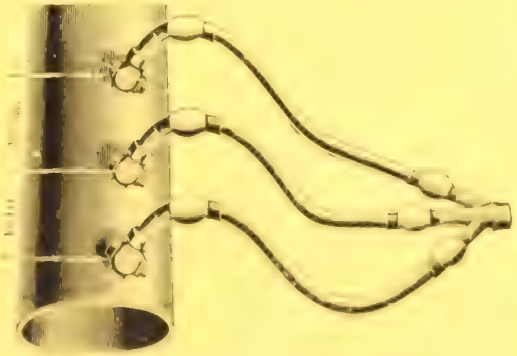
Iron and Lead Pipe.
Iron Pipe Fittings.
Kerb Boxes.
Iron Gate Valves.
Water Relief Valves.
Reducing Pressure Valves.
Combination Waterworks Gauges.
Recording Pressures Gauges.
Altitude Gauges.
Revolution Counters.
Draft Tube Gauges.
Thermometers.
Hose and Hydrant Cocks.
Lead Flanging Tools.
Hemp and Jute Packing.
Pipe Joint Grease.
Pipe Fitter's Tools.
Stocks and Dies.
Pipe Wrenches and Vises.
Oily Waste Can.
Oil Filters.

Full particulars mailed on application.



LEAD FLANGE KERB COCKS.

Stop and Stop and Waste, for Flanged Lead Pipe or Flanged Lead and Iron Pipe.



BRANCH GOOSE NECKS.

Two to Eight Branches with Unions

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

The James Morrison Brass Mfg. Co., Ltd.

93-97 Adelaide St. W. ∴ Toronto

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

Canadian Consolidated Rubber Company Limited

Executive Offices, Notre Dame Street, MONTREAL, P. Q.

Selling Agents for

Dominion Tire Company, Limited, Berlin, Ont.
The Canadian Rubber Company of Montreal, Limited, Montreal, Que.
The Granby Rubber Company, Limited, Granby, P.Q.
The Merchants Rubber Company, Limited, Berlin, Ont.
The Berlin Rubber Manufacturing Company, Limited, Berlin, Ont.
The Maple Leaf Rubber Company, Limited, Port Dalhousie, Ont.
Dominion Rubber Company, Limited, St. Jerome, P.Q.
Berlin Felt Boot Company, Limited, Berlin, Ont.

Rubber Goods Best by Test for all Purposes

- Air Brake Hose (regular) and Special "Nonfreezing"
- Air Signal Hose
- Steam Heating Hose
- Vacuum Hose
- Hot Water Hose (White)
- Cold Water Hose
- Air Hose—for Drills and Pneumatic Tools
- Hose Bags—Corrugated
- Heavy Suction Hose
- Wire-lined Gas Hose
- Fire Hose and Supplies
- Hose for every special use

- "Star" Red Sheet Packing
- "Canadian" Spiral Packing
- Pure Gum Sheet
- Valves—For Hot and Cold Water (all densities for any pressure)
- Pebbled (Dot) Rubber
- Moulded Mats
- Hammer Bumpers
- Air Brake Caskets
- Special Moulded Goods for every mechanical use
- Tubing—all sizes
- Rubber Strips

Rubber Boots and Shoes

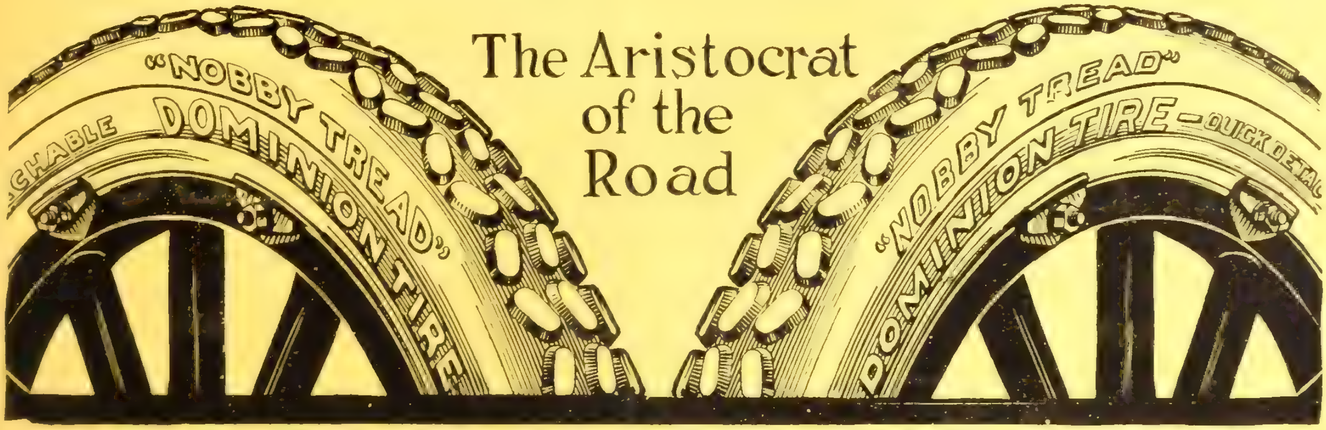
"Jacques Cartier," "Merchants," "Dominion," "Anchor," Brands.
Fleet Foot Outing and Sporting Shoes. Felt Boots and Specialties "Berlin" Brand.

Automobile Tires Truck Tires Carriage Tires

Original "Diamond" designs Inlaid Rubber Tiling. Estimates and samples cheerfully furnished. We specialize in Rubber Goods required by Steamboat and Electrical Car Companies. Write for catalogues and prices.

— BRANCHES —

Halifax, Hamilton, Calgary, St. John, Brantford, Edmonton, Quebec, London, Saskatoon, Montreal, Berlin, Regina, Granby, Port Dalhousie, Vancouver, Ottawa, North Bay, Victoria, Toronto, Winnipeg


"NOBBY TREAD" DOMINION TIRE
The Aristocrat of the Road
"NOBBY TREAD" DOMINION TIRE—QUICK DETAC
CHABLE

TWO TIRES IN ONE

This is what the "Nobby Tread" Tire practically is---two wear-resisting Tires in one

The big, thick, tough rubber "Nobs" that prevent skidding, are made on a big, thick, extra strong additional strip.

Then this heavy strip is welded by hand and vulcanized on to an extra heavy, extra strong tire.

You have got to wear out the big, thick, tough "Nobs" of rubber before you even start to wear out the extra strong tire underneath.

Then comes the great big difference in the **quantity** and the **quality** of the rubber and of the fabric that is used in "Nobby Treads."

An **unusually large amount** of rubber and fabric is used in "Nobby Treads," and
—only the very toughest and the best rubber, and
—only the strongest, especially selected fabric.

Then don't forget this fact—rubber quality can differ and fabric quality can differ just as much as the quality of leather can differ.

These are the reasons for the history-making mileage records of "Nobby Tread" Anti-Skid Tires during the past four years, and based upon these mileage records we recently announced that

"NOBBY TREAD" TIRES

are now sold under our regular warranty perfect workmanship and material BUT any adjustments are on a basis of

5000 MILES

The unusual wear [illegible] tire quality
—the quantity of rubber.
—the quantity of fabric.
—the method of construction.
all have been rigidly maintained in "Nobby Tread" Anti-Skid Tires.
—and maintained regardless of cost.
—and maintained regardless of price competition.

"Nobby Tread" Tires are REAL anti-skid tires, and mile for mile, dollar for dollar, they are by far the most economical tires.

Canadian Consolidated Rubber Co., Limited

28 Branches throughout Canada **SELLING AGENTS** **MONTREAL, P. Q.**

NOTE THIS: Dealers who sell DOMINION "NOBBY TREAD" Tires sell the [illegible]

Across Canada with the

IMPERIAL WIRE & CABLE CO.

LIMITED

Toronto - MONTREAL - Winnipeg

Fourth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows the

Electric Railway Chambers

Winnipeg

This building was wired with

"Imperial Higrade" Rubber Insulated Wire

Architects	Pratt & Ross, Winnipeg
Engineers	Neiler, Rich Co., Chicago
Electrical Contractors	Schumacher Gray Co., Winnipeg

Northern Electric Company

LIMITED

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver Victoria

Successors to IMPERIAL WIRE & CABLE CO., LTD.

Correspondence previously addressed to Imperial Wire and Cable Co. at 611 C.P.R. Building., Toronto, and 902 Electric R. Chambers, Winnipeg, should now be addressed to the Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.

The Kahn System
of Reinforced Concrete

Embraces the following well known products.

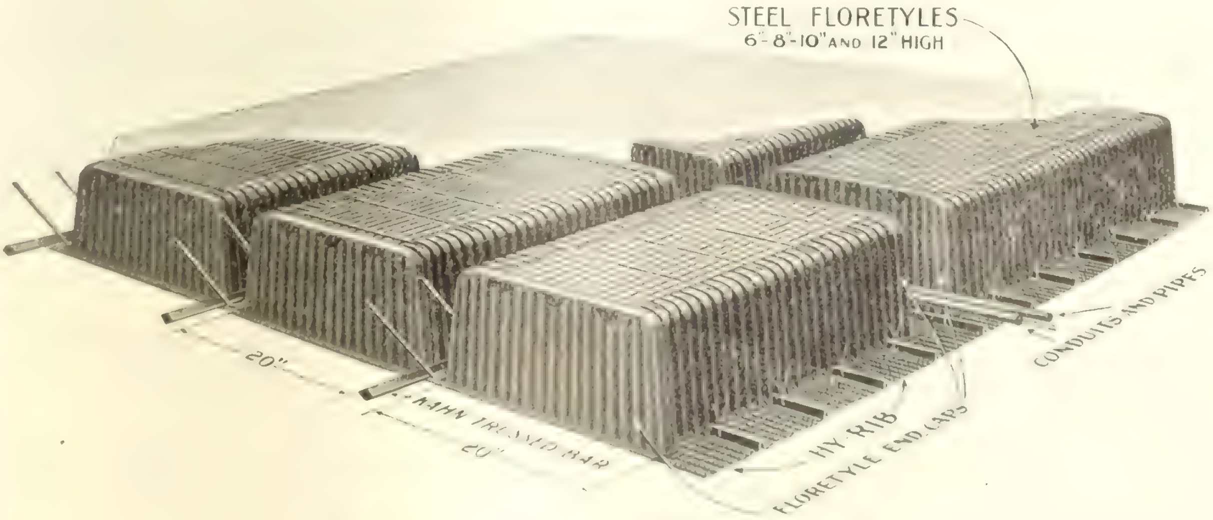
Kahn Truss Bars for reinforcing beams and footings.

Rib Bars Square deformed section, for concrete columns, walls, slabs, beams, etc.

Rib Metal—Steel mesh for floor and roof slabs, walls, conduits.

Hy-Rib Consists of a perfect steel lath surface stiffened by rigid high ribs manufactured from a single sheet of steel. Used as a reinforcement for floors and roofs without centering. No studs required when used for plastered walls and partitions.

Steel Floretyle Construction—Light, fireproof, soundproof, reduces cost of hotels, office buildings, apartments, etc. Write for booklet.



Kahn Steel Sash

for use in factories, warehouses, power houses, etc., is made of specially rolled mild steel sections.

SPECIAL FEATURES OF SASH

Fireproof, weather proof, permanent Double Contact Ventilators, hinged on Kahn's Patent Hinges.

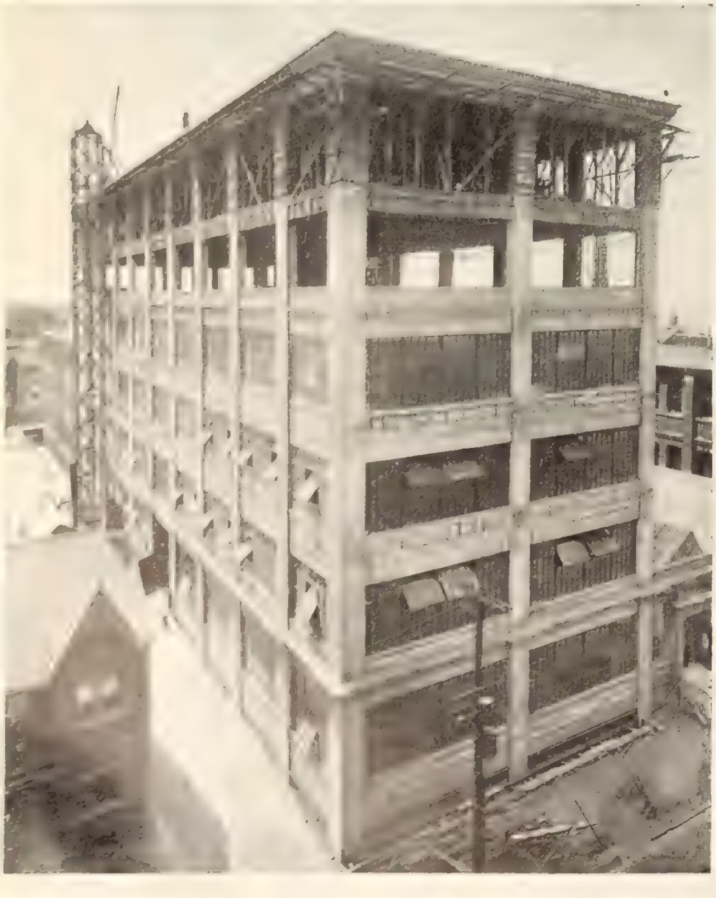
Trussed Concrete Steel Co. of Canada, Limited

Head Office and Works: Walkerville, Ont.

Branches:
Montreal, Halifax, Toronto, Fort William, Winnipeg, Calgary, Regina, Vancouver.

Efficient and Economical Construction Work

Fireproof Factory for Rolph & Clark, Limited
Lithographers, Carlaw Avenue, Toronto



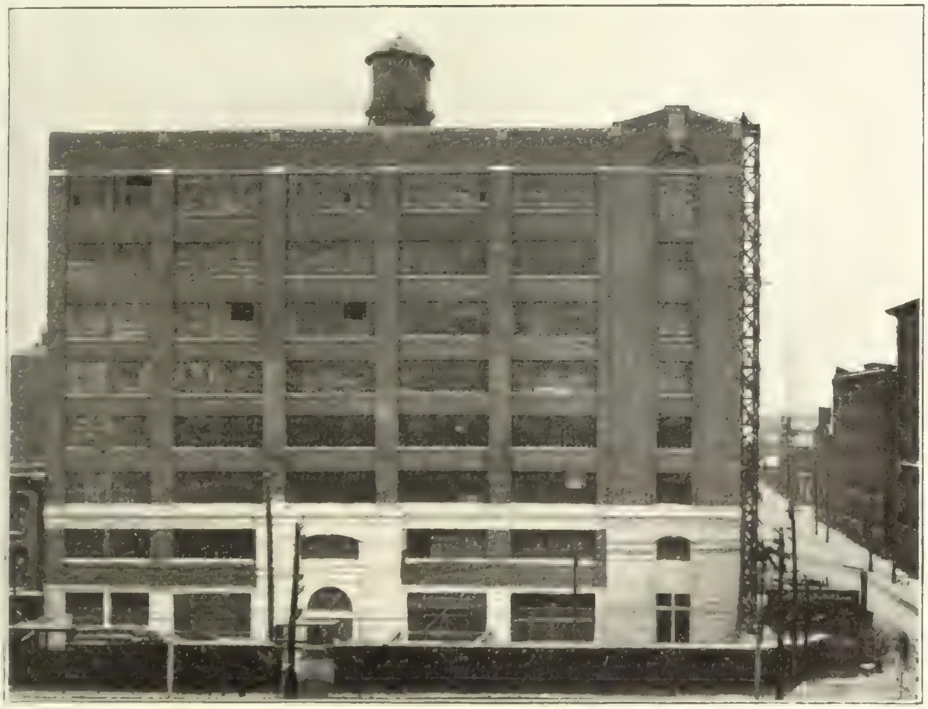
Reinforced Concrete
Factory
For
Gutta Percha & Rubber
Company, Limited
O'Hara Ave.
Toronto

Jennings & Ross
Limited
Engineers and Contractors
Toronto

Royal Bank Bldg. King and Spadina
Phone Adelaide 292

Fireproof Construction

A Specialty



Steel and Concrete Construction of Nine Storey Factory for Christie, Brown & Company Toronto

Kingston Road Sewer—Edgewood Avenue to Woodbine Avenue, Toronto, showing 35 ft. excavation and the heavy timbering.

Jennings & Ross

Limited

Engineers and Contractors

Toronto

Royal Bank Bldg. King and Spadina

Phone Adelaide 292

A Letter From Mr. Quereaux of Texas

"I have just returned from the most wonderful demonstration of a Hauling Outfit that I have ever witnessed, or I believe has ever been undertaken. The five Troy Reversible Trucks sold to Mr. Cox, of this city, arrived here on Wednesday. We had them on the ground and coupled together at eleven p.m. Thursday night. Early Friday morning we loaded them with supplies for the commissary, 6 tons of gasoline in steel drums, a complete saw-mill—a big one at that—a hundred sacks of oats and things too numerous to mention, in all a total tonnage, as near as I could estimate, of 32 tons. The first mile of Palestine streets was fairly good and when we started it seemed as if all the inhabitants of Palestine and surrounding country were there. The streets were narrow and before leaving town we made two right-angle turns and the manner in which the train followed in track around these corners attracted considerable attention and caused one old man to remark: "How did you learn 'em " The first twelve miles of road was deep sand and somewhat hilly, but the 10-inch tires carried the load very nicely and we went along with scarcely any trouble. Only once was it necessary to cut the train apart, and then it was more the fault of a new fill that was extremely soft and it would have been possible to have gone over this had I zigzagged the wheels to cover more surface of this soft roadway. We left the road entirely and began another twelve miles of winding trail through swamps, marshes and virgin forest, in some places a mere path winding in and out of the trees. A bunch of nigger axe men went ahead and cut out trees, stumps and rolled logs out of the way, making the road as passable as possible. At first we watched the wagon train very carefully for fear it would cut the corners and run against the stumps of trees, but we found this unnecessary, for no matter how severe the angle or narrow the trail, the wagons followed in track of the tractor. We forded streams and crawled up banks four and five feet high, went over places that it would be almost impossible for a team to carry an ordinary load, and in some places it was necessary to hew two inches off the sides of trees in order to let the tractor through. The wagons followed along and simply took care of themselves. It was a hard trip and for two nights we slept on the ground with a fire at our backs and a sack of oats for a pillow. Our grub ran out Saturday afternoon, but we were fortunate enough to strike a nigger nestor's shack Sunday morning where we got a 'snack' which lasted us until we reached camp Sunday afternoon. I feel well repaid for making this trip, for one has to 'see to believe' and this has been to me a most valuable experience in the hauling game, and I know that there is no freighting proposition or road condition that TROYS will not negotiate successfully."

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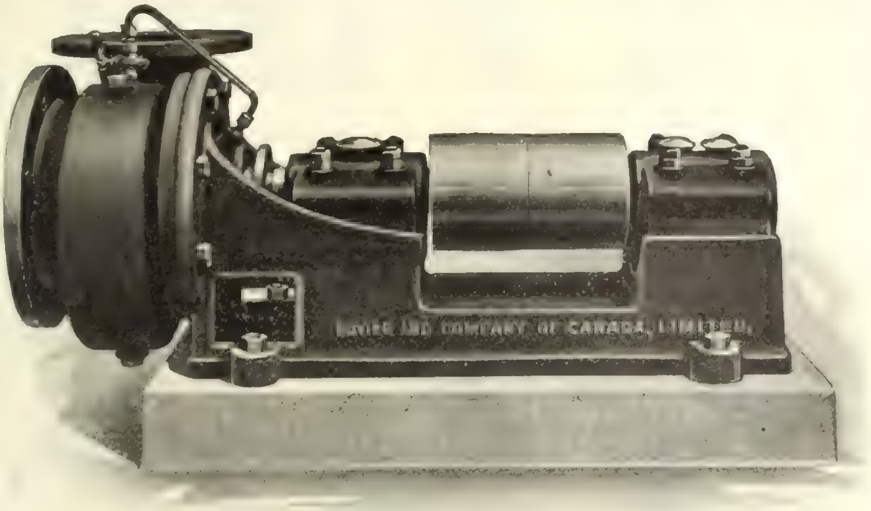

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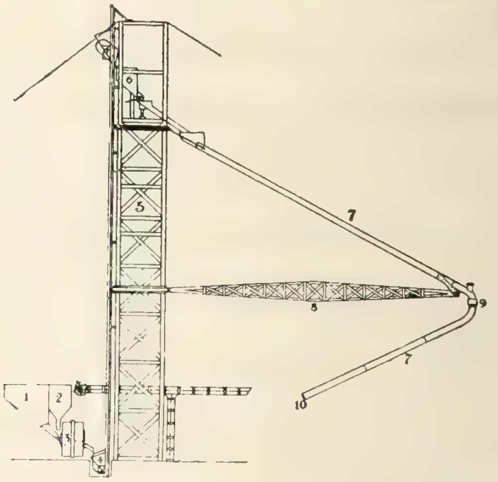

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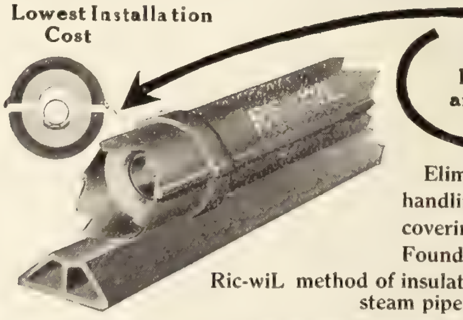

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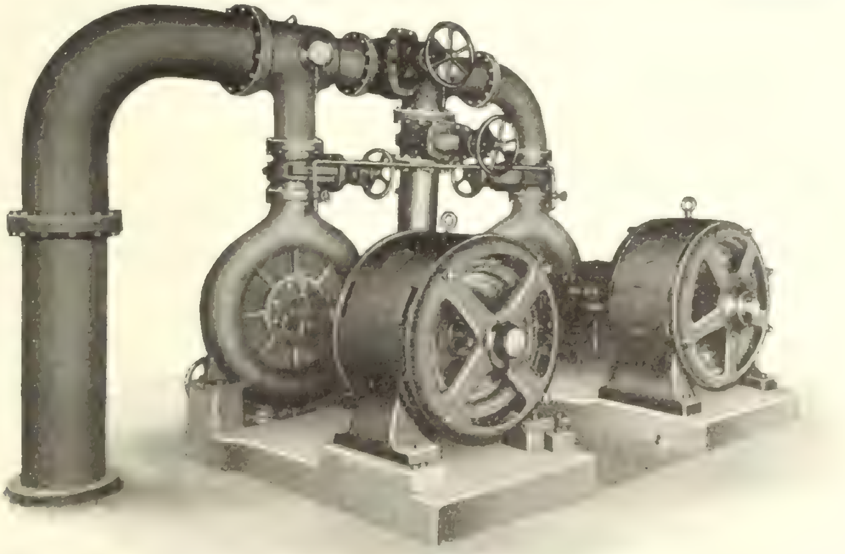

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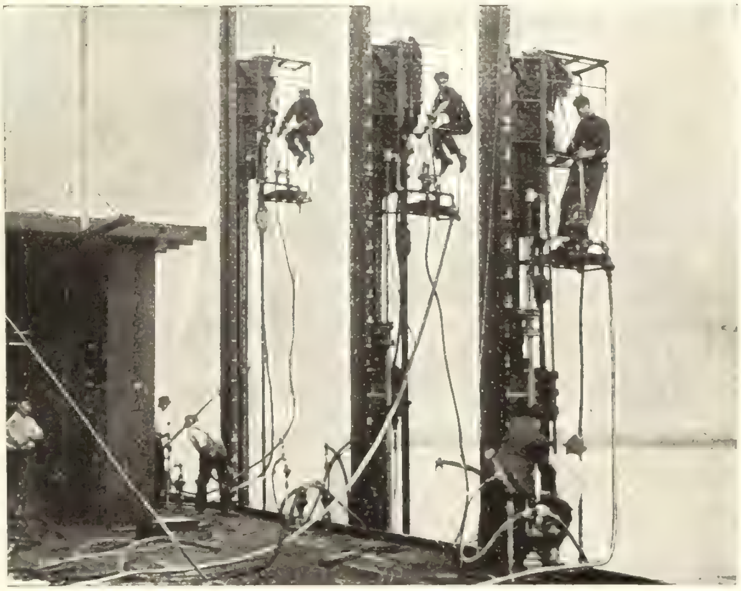

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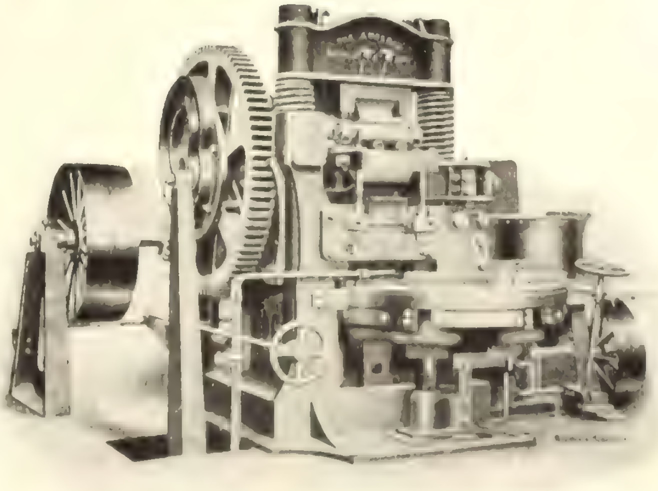

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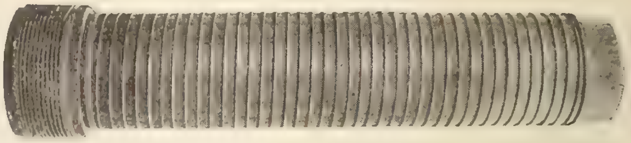

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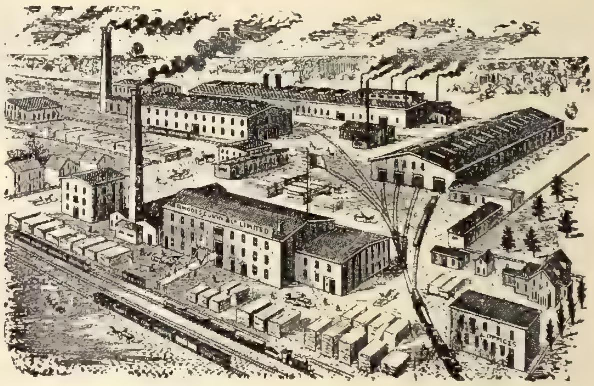

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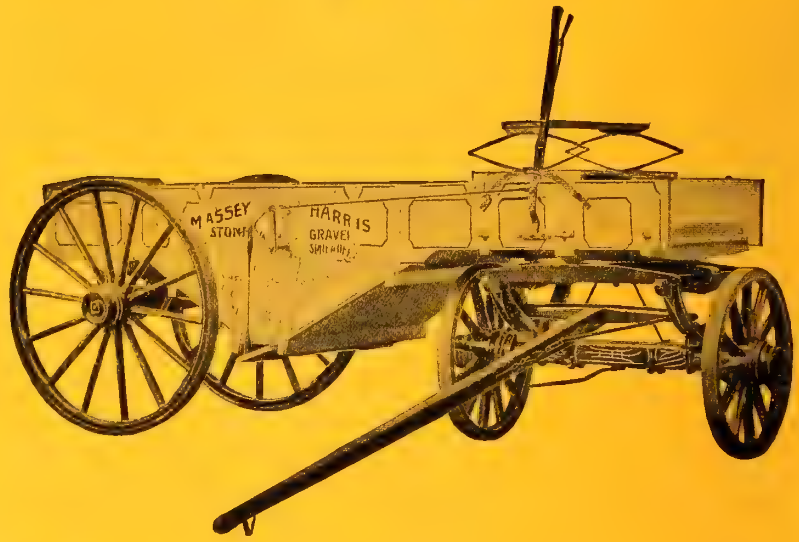

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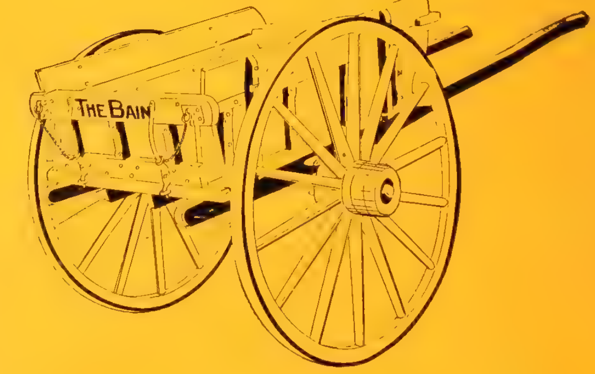

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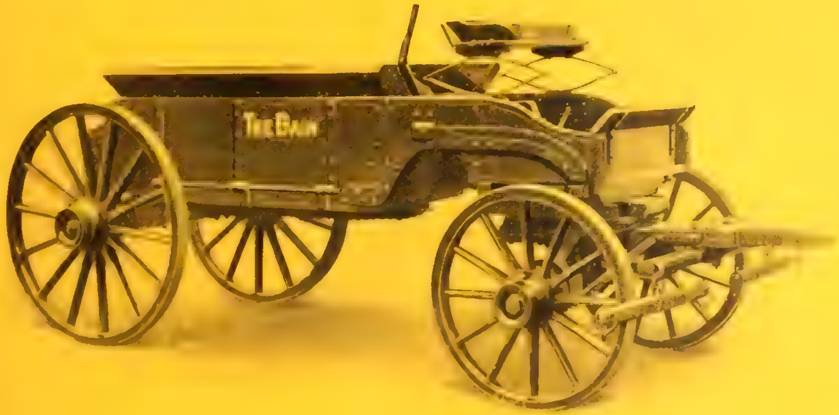

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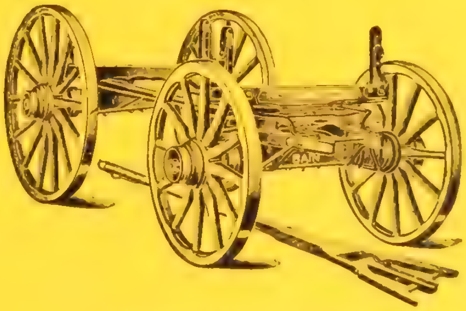
Body is of improved design.
Quick winding device and positive lock.
The newest and best dump wagon on the market.

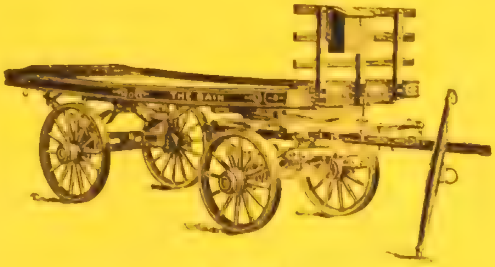
The general contractor will find much of interest in our line

Dump Wagons, Dump Carts, Dump Boxes, Heavy Teaming Gears, Bolster Springs, Grading Plows, Gasoline Engines, Power Hoists, Pumps, Sleighs, etc., specially designed for the uses for which they are intended and built in the most thorough manner in our own factories.

Full information on request.



Heavy Teaming Gears
Steel axles or steel skeins.



Lorries
Steel axles or steel skeins; one-horse or two-horse.

Gasoline Engines direct connected pumps and hoists, specially adapted to the needs of the contractor

Massey-Harris Co.

Limited

Head Offices—TORONTO, Canada

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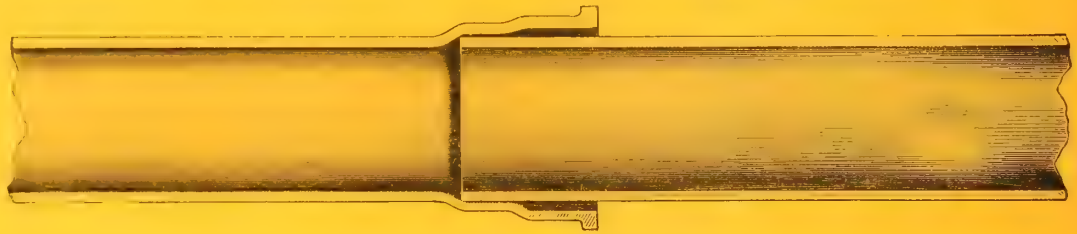
—Agencies Everywhere

"Phoenix"

Seamless and Lapwelded Steel, Bell and Spigot Pipe



Sizes, 2 inches to 60 inches.

For Penstocks, Flumes, Water and Gas mains, Building Columns, etc., "PHOENIX" pipe is giving efficient service and satisfaction to users in all parts of the world.

"PHOENIX" pipe is rolled from the very best mild, Siemens-Martin steel, produced in the Phoenix Steel Works' own plant.

Pipes can be supplied of sufficient thickness to permit of [illegible] service connections being made without the use of saddles. The brass Corporation cocks can be screwed directly into the mains, making a tight joint.

HEAVY STEEL PIPE, while no higher in initial cost, will have a longer life than any of the light gauge steel pipes now on the market.

"PHOENIX" steel pipe is now largely used in place of cast iron pipe, in comparison with which it possesses the following distinct advantages:—

1. Protection against breakage.

The high degree of elasticity which the steel produced by the Phoenix Steel Works possesses, renders Phoenix Pipe capable of withstanding a considerable amount of pressure both from within and without, which is of special importance in shifting ground and in cases of unexpected strains.

2. Considerably lighter weight.

The weight of "PHOENIX" steel pipe is very much less per foot than that of cast iron pipe. This means a great saving in cost of transportation, and cost of laying.

3. Greater working lengths.

The normal random length is about 20 to 30 feet, but of required the pipe can be supplied in lengths of 40 to 60 feet. A considerable saving in caulking material and in cost of laying the pipe is effected thereby, besides which, because of fewer joints, there is less risk of interruption in the normal working of the pipe line.

Every "PHOENIX" pipe is asphalted inside and out in the HOT state and can also, if desired, be supplied wrapped SPIRALLY with strips of jute saturated with hot asphalt, thereby ensuring a permanent protection against corrosion.

Every "PHOENIX" pipe is subjected to a high pressure hydraulic test before shipment from the works.

SPECIALS are all manufactured from the same grade of steel as the pipe itself.

When required, Phoenix Pipe can be supplied with other types of joints than the one above illustrated

"Dusseldorfer" Seamless Steel Tubes

For Boilers and Superheaters

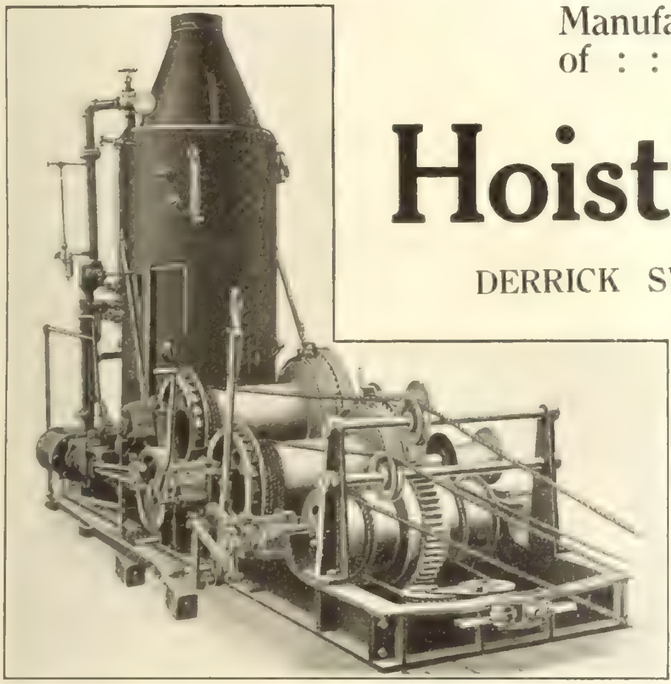
The requirements of steel Tubes for boilers and superheaters are of the most rigid nature. Absolute safety and maximum efficiency are the first principles of a perfect boiler or superheater tube. That's why "Dusseldorfer" tubes are specified by the most exacting users.

Inquiries and specifications solicited!

Gerald Lomer, Limited, Montreal

Canadian Sales Agents for: Phoenix Steel Works, Dusseldorf & Hoerde, Germany

The Doty Marine Engine and Boiler Co., Ltd.

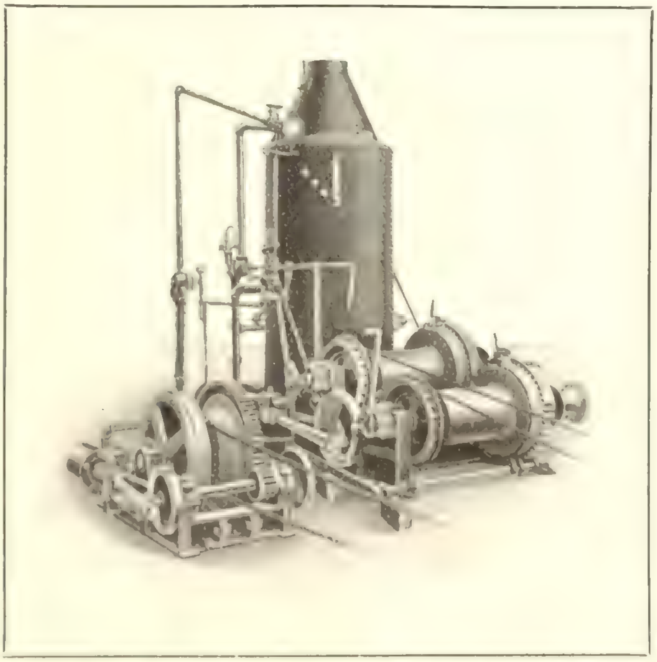


Manufacturers of : : : : : : **Superior**

Hoisting Engines

DERRICK SWINGERS, MATERIAL ELEVATORS
SAFETY MINE CAGES, ETC.
MARINE ENGINES AND BOILERS

This half-tone illustrates our Double Cylinder, Double Friction Drum Hoisting Engine with Improved Pony Friction Drum Boom Swinger attached. Its general appearance will manifest the superiority of our designs which appeal to every buyer and user of our Hoisting Engines. Note the trolley in front permitting the double sheave tighteners to travel back and forth as the swinging ropes wind and unwind from the pony drums alternately, thereby avoiding the ropes crossing over each other on the drums; also the rigid stands with extra large shafts carrying two bronze bushed sheaves leading the hoisting ropes clear over the swinging drums. Our ratchets are cast separate from the drum flanges and the pawls drop out automatically when released and remain out until engaged by the operator. The crank pins are extra large and the connecting rods of steel, cross heads of the hanging type working on steel guide bars and improved throttle valve comprise the leading external features of our improved Hoisting Engines.



This cut illustrates our Hoisting Engine in combination with our independent Steam Derrick Reversible Swinging Engines. The advantages of an independent swinger are, increased power of the main hoisting engine, increased swinging power, easier control, while the division of weight into two machines facilitates change of position more readily and permits the engine being closer to the derrick where limited for space.

Our single drum builders' Hoisting Engine having double cylinders with reversing link motion and large sheave wheel for operating two cage material elevators furnished complete with all sheave wheels, wire rope guides and tighteners is the most substantial constructed machine and in every way the most complete and durable outfit for the building contractor.

For further particulars, prices and deliveries, write

The Doty Marine Engine and Boiler Co., Limited

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The Doty Engine Works Co. of Winnipeg, Ltd.

WINNIPEG, MANITOBA

To buy our Engines is a guarantee of satisfaction

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Screened Sand. Roofers Gravel. Graded Gravel. Crushed Stone.
Capacity 10 to 15 cars per day. Pits at Erin, Ont., C. P. R.
1,100 feet above lake level, absolutely free from clay,
silt or organic matter. Sharp clean sand.

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Hard Wall Plaster

HARD-WALL PLASTER HAMMER BRAND HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

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Salt Glazed and Vitrified

SEWER PIPES

True to Size.
Impervious to Water.
Sizes manufactured and always in stock 4 in. to 24 in.

Ask for Price List and Discounts.

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Chimney Tops
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TELEPHONE (Toronto Connection)
PARK 1809

The Dominion Sewer Pipe Co.
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SWANSEA (near Toronto)

E. G. M. Cape & Company, Limited, *Head Office:* New Birks Bldg., MONTREAL
Engineers and Contractors General Building Construction Montreal and St. John, N.B.

Some Contracts Undertaken This Year

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Ferguson Steel & Iron Co.

Buffalo, N. Y.

Warehouses;—Bailey Ave., South of Broadway

Complete Stock Always On Hand

BARS;—Flat, Round, Square and Concrete.

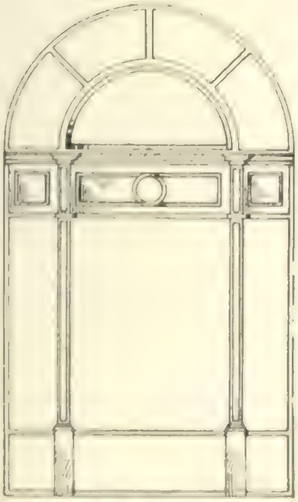
PLATES;—Flange, Tank, Universal and Diamond.

SHEETS;—Blue Annealed, No. 8 to No. 16 Gauge.

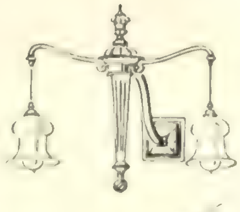
SMALL SHAPES;—Angles, Channels and Tees.

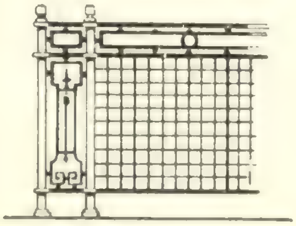
STRUCTURALS;—Angles, Beams, Channels, H. Columns and Tees.

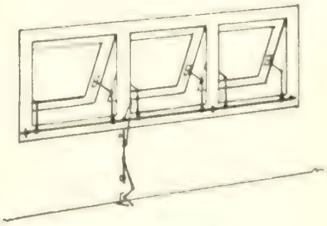
IMMEDIATE DELIVERY ***Send for Monthly Stock List***

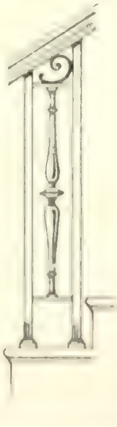


ORNAMENTAL BRONZE WINDOW









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SPECIALISTS IN METAL CASEMENTS, STEEL SASHES, LANTERNS & GEARING :: :: :: ::
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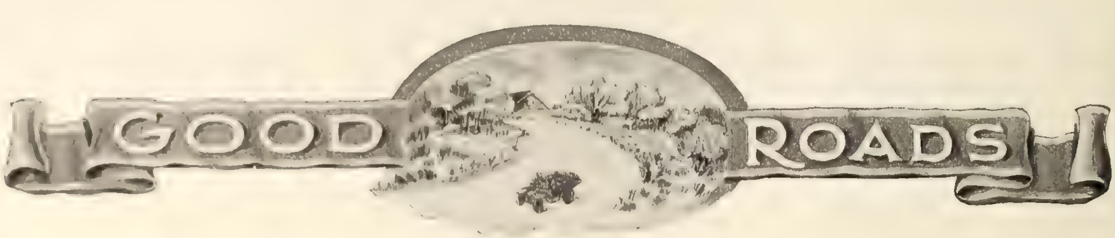

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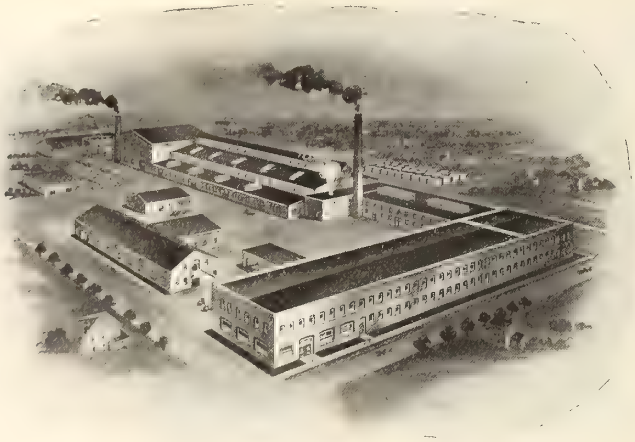
Complete Portable or Stationary Rock Crushing Plants; Stone Elevators and Screening Machinery; Road Graders; Road Drags; Road Plows; Street Cleaners, Sprinklers and Sweepers; Street Cleaners' Hand Carts; Drag and Wheeled Scrapers; Portable Engines and Boilers.



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TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

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MEXICAN EAGLE ASPHALT

BECAUSE:

1. It is more cementitious than other asphalts.
2. Water will not readily injure it.
3. Exposure to sun and air will not cause its deterioration.
3. It has great cohesive strength.
5. It is more ductile and flexible than other asphalts.
6. Shocks will not crack it. It is very malleable.
7. We will supply asphalt having the proper penetration for your needs.
8. It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it.
9. It has over 99 per cent. bitumen. Purest on market — therefore free from deleterious matter.
10. It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

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The Asphalt and Supply Co., Limited

Sole Canadian Agents for the Mexican Eagle Oil Co. Limited

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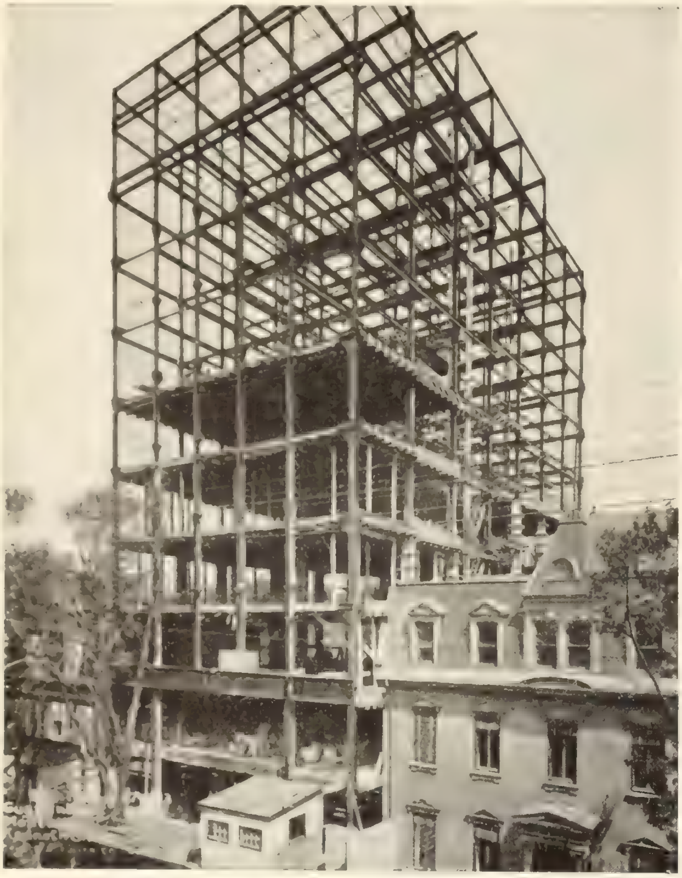

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Structural Steel for Every Purpose

Steel Buildings of every Description Furnished and Erected

We carry in stock 8,000 tons of structural shapes and plates and are in position to make prompt shipment of plain or fabricated material.

Capacity 18,000 Tons Annually

Structural Steel Co., Ltd.
Montreal

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

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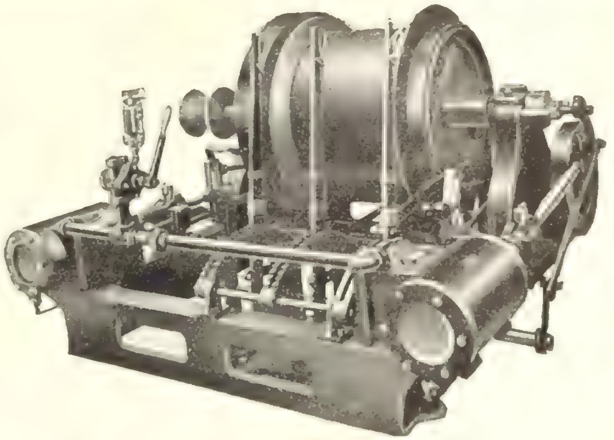
Mining Hoists



Our improved Mining Hoists are especially convenient for the operator besides being quick and reliable in their work, and economical of steam.

We can make quick delivery of rush orders.

WE ALSO MAKE:

Ore Buckets, Mine Cars, Elevator Sheaves, Boilers,
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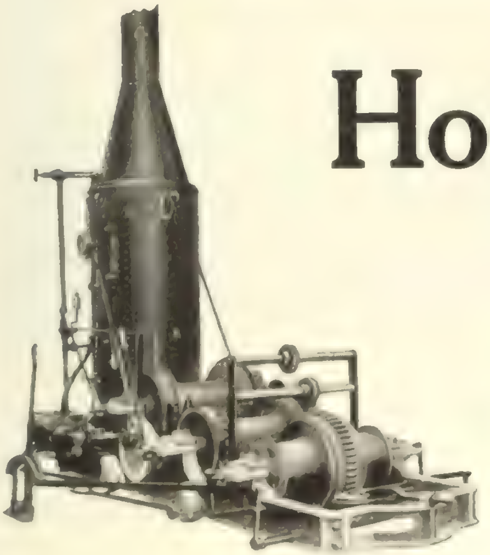

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Hoists made to order. If you have a difficult hoisting proposition let us solve it for you.

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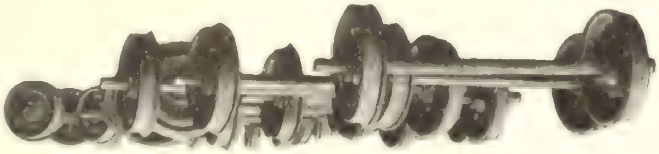

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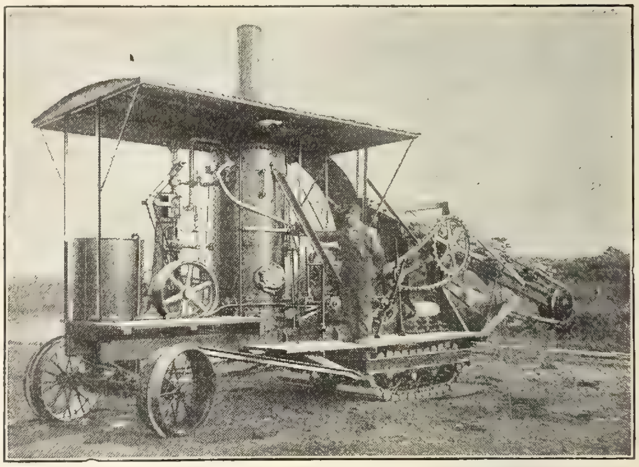
Among other progressive Canadian cities—use the

Austin Trenching Machine

THE AUSTIN is not sold by mere argument or by spacious representation. By *actual test*— under local conditions— the AUSTIN sells itself. The fact that Canada's leading cities use it—for excavating in every conceivable form of soil—proves the AUSTIN to be an unequalled trencher, for service and economy.



BEYOND remarkable efficiency, work has been done at the low cost of

$2\frac{4}{10}$c per Cubic Yard

This was the operating-cost record of recent excavating at Medicine Hat, in hard clay and boulders, with a Number O AUSTIN TRENCHING MACHINE.

When realizing this, no contractor can afford to be without the AUSTIN TRENCHING MACHINE.

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F. C. Austin Drainage Excavator Co.

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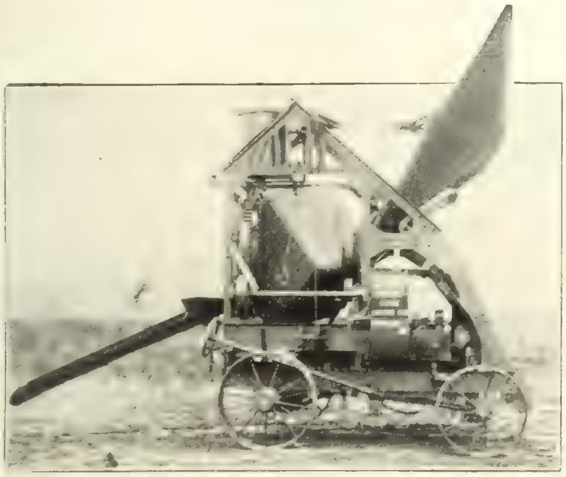

Run this Machine 9 months ——— and it's Yours!

We mean just what we say. Nine months of work will actually show savings enough to return you the full price that you paid for

The
AUSTIN Cube Paver
(Steam or Gasoline Power)

This one-man operated, rapid working street paver will actually save you $7.00 to $10 a day in **labor costs alone,** as compared with most other mixers.

It's this way. First, there's the one-man operation. All levers are within reach of just one operator. All levers are actually within a three-foot circle. The operator touches the lever that causes the machine to discharge, another that operates the big, rapid-moving loading skip, another lever still that closes the door at the discharge-end **that prevents slopping of concrete.** One man—one salary—and such **simplicity** that this man needn't deserve a high salary at that.

And here's the second saving of this new Street Paver. It has a 10-foot chute that swings on a pivot and covers a range of nearly 22 feet without moving the machine. We say "covers" because this is actually the case. This chute has hinged sections three feet apart, which makes it possible to place concrete at any desired point within reach of the chute. See THIS point?

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Built in two sizes—13½ and 22½ cu. ft. of loose material. Can furnish with either gasoline or steam power.

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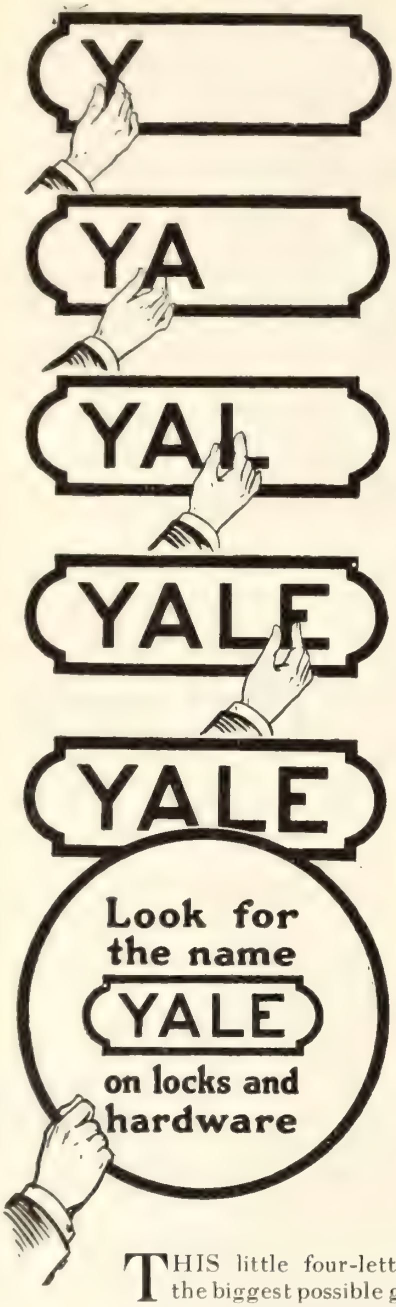

THIS little four-lettered word is the biggest possible guarantee you can have of quality, security and fitness in Locks, Padlocks, Night-latches, Door Closers, or Builders' Hardware.

Back of this guarantee stands an enviable record of successful achievement, built upon better goods, made in a better plant, and by better workmen.

Any good hardware dealer can show you Yale Products. Yale Locks and Hardware sold in Canada are now made in Canada.

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Your responsibility to the architect

who gives you an important contract is greater than merely following specifications. For if there is dissatisfaction with the finished job on the part of the client, the architect—consciously or unconsciously—is going to lay a good part of the blame on you. Many a contractor has gotten in wrong with an architect through failing to catch the "spirit" behind the written specifications.

So when you find a specification calls for

Dougall Varnish

—" or just as good"—remember that the "just a good" goes in as a matter of habit. Few architects who have really tested varnishes ever make the error of thinking there is a substitute that will give the same wonderful wear and absolute satisfaction as DOUGALL VARNISHES.

When you see "Dougall Varnish" in the specification, figure on Dougall Varnish—and use it on the job. Then you can't go wrong. There is a Dougall Varnish for every purpose—a guarantee for every can.

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MONTREAL, QUE.

Associated with Murphy Varnish Co., U. S. A.

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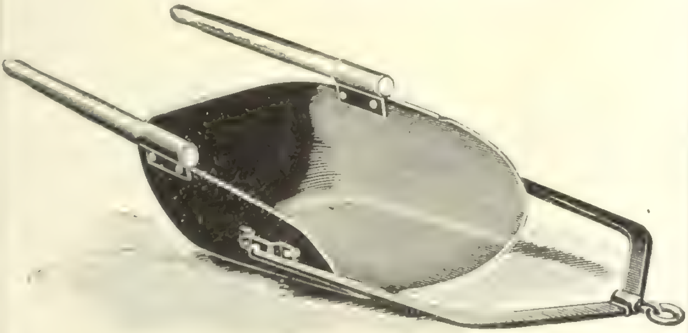

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Our DRAG SCRAPERS have pressed bowls of high carbon steel all joints and seams being eliminated. They are stiff and serviceable. WHEEL SCRAPERS can be supplied with either square pan or pressed bowl and have the latest and most approved dumping attachments.

Always order by the name—

IRON AGE

Our STEEL TRAY BARROWS with trays pressed from solid sheets of high carbon steel, without seams or joints, are the standard with all the leading contractors.

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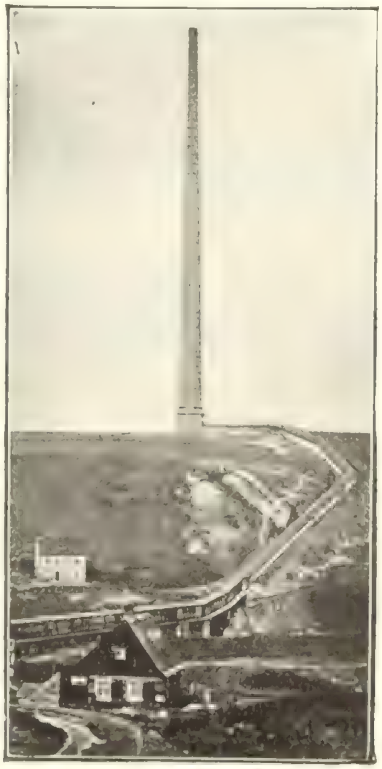

460 feet x 8 feet 2 in.

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Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

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will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

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every size for Water, Gas, Culvert or Sewer, **Carried in Stock**

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Hope Steel Sash For All Buildings

"Make your windows as strong as your walls." In the equipment of factory windows there are six important points to be considered— Fire-proofness, strength, appearance, durability, light and ventilation.

There are only two materials to choose from—steel and wood. The architect and engineer must decide which of these offers most of those features. Hope Steel Sash provides every one of these essential qualities. It is made from the best material obtainable, is absolutely fire-proof, handsome in appearance, scientifically constructed with every joint interlocked, practically indestructible and provides maximum light and ventilation.

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More Light and Better Ventilation

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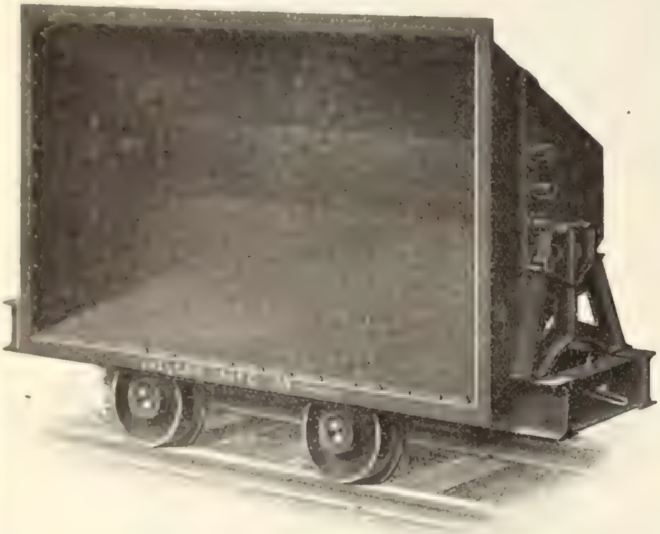
Write for our No. 20 catalog describing Weller Machinery in full.



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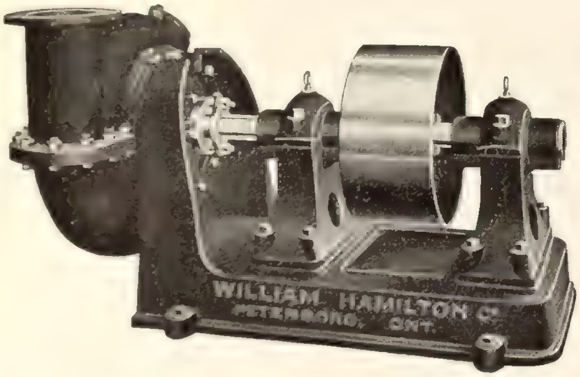

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invest Thousands of DOLLARS in new and expensive Equipment, when you know that it will be idle after two or three months' work.

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You can rent from us a complete contractor's outfit for any length of time, and at very reasonable rates.

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Corrugated Iron is Different When it is "Metallic"

The story of Corrugated Iron is not a hard one to tell.

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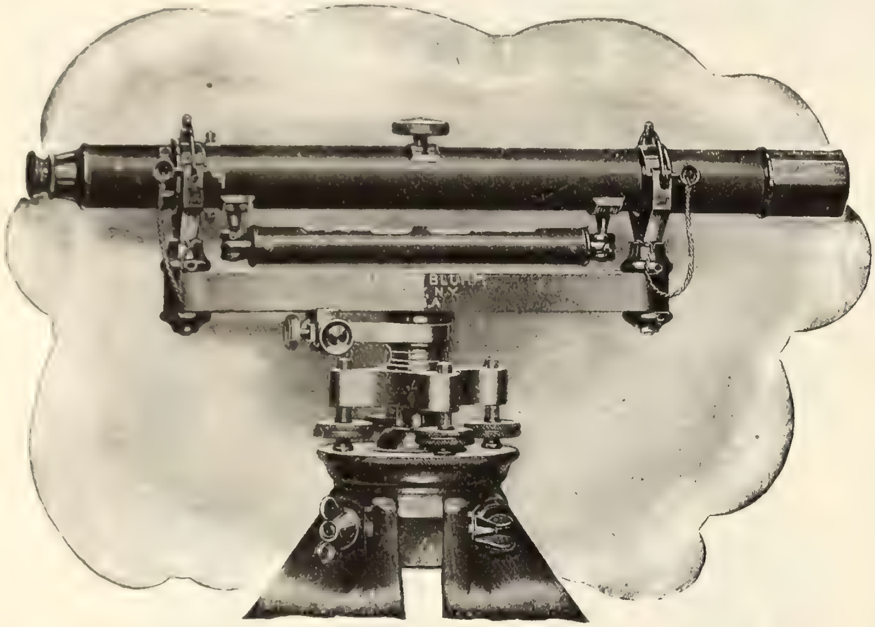

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(Trade Mark Registered)

Gives Longest Service Per Dollar of Cost

ACCURATE tests of various roofing materials—slate, tile, prepared roofings, composition roofs, metal, and wooden shingles—have proven conclusively that RU-BER-OID Roofing costs least per year of service.

RU-BER-OID is the original prepared roofing. The first roofs laid with RU-BER-OID, 22 years ago, are still weatherproof and appear to be good for years more of service.

RU-BER-OID is unaffected by extremes of temperature, by the severest weather conditions, or by gases, fumes or acids, and so can be used where other roofings would be practically useless. As it is light in weight, it saves in cost of roof framing. It can be laid by unskilled labor at very small expense.

RU-BER-OID has many special uses, such as a waterproof covering over concrete roofs (Chateau Laurier, Ottawa) and as a waterproof layer in bridges under which traffic passes (over C.P.R. tracks on Notre Dame St. East, Montreal.)

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(Colored Ru-ber-oid, Can. Patents Nos. 93,027 and 93,160)

KA-LOR-OID Roofing is exactly the same roofing as the regular slate-colored RU-BER-OID, with the addition of a color. By our patented process the beautiful, soft shades of red and green are made an integral part of the roofing, so that they are absolutely permanent.

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compared with ordinary building papers is like a thick woollen blanket compared with an ordinary cotton sheet. It is really light-weight RU-BER-OID Roofing saturated with the same tasteless, odorless gum which gives RU-BER-OID its recognized superiority.

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Special Features

Centrally located at Adelaide and Charlotte Streets.
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The great feature of this new light is strength with simplicity of construction. The light, which is constructed entirely of steel assembled by the Oxyacetylene Welding Process, consists of but three parts and is made to stand the roughest handling by unskilled labor without injury. One of the distinct advantages of the Garrow Light is that it can be used in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

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Elevating and Conveying Machinery

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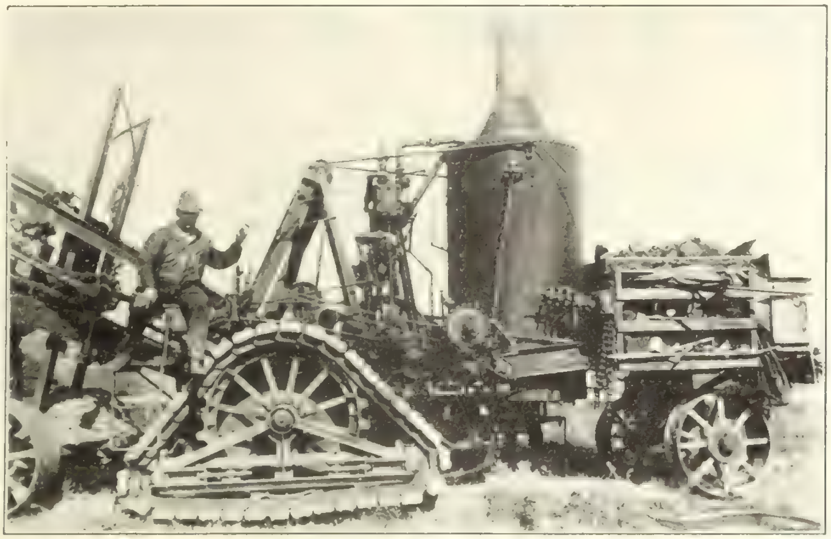

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One machine digs any width between 28 and 78 inches and any depth to 20 feet, without change of parts.

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High Calcium Lime

Manufactured by

The Dominion Lime Company,

SHERBROOKE, - - PROVINCE OF QUEBEC

Its Special advantages are:

**Strength,
Whiteness,
Purity**

Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

Current Prices of Building and Engineering Materials

General Review of Trade Conditions

General trade conditions in the building field [illegible] [illegible] improvement on those of a month ago. There is every indication that constructional operations are developing fast in most parts of Canada despite the late spring and the stringent financial conditions. Inquiries made amongst contractors have elicited the information that the demand for practically every class of building material has increased of late with quite remarkable rapidity. Reports from the principal brick plants go to show that in nearly every case they are working to the limit of their output. In and around Toronto particularly, some of the manufacturers of clay products have sufficient orders on their books at present to suffice for the running of their plants at capacity for the next couple of months. Everywhere there are evidences of increased building activity. In the next few weeks work will be started on a large number of important buildings, contracts for which will open up an increased demand for such material as structural steel and brick of various kinds. In Montreal and other Quebec centres brick is in fair demand and some of the stocks left over from last year are being rapidly depleted. It is reported however, that the demand at the present moment shows a tendency in favor of brick of the lower grades, suitable for the construction of houses of a cheaper kind, and that as regards the better qualities of brick, orders have not apparently come in as promptly as anticipated. The steel trade is not as active as was the case some time ago, and immediate prospects of improvement in this respect are not by any means promising. Large manufacturers in particular are said to be doing very little. Crushed stone is in moderate request all over Eastern Canada. The same applies to sand and gravel. The lumber trade, generally speaking, has improved considerably and most dealers are doing as great a business as a year ago, but prices in most cases are below normal. The increasing activity in building operations has had a marked effect on the cement trade with the result that many large orders are being placed with Canadian firms. To summarize the situation in the constructional field, the prospects for a season of comparative prosperity and activity are exceedingly promising.

At Vancouver, the demand for all classes of materials required in various forms of construction work has undergone noticeable improvement since the beginning of April, the present condition of business being noticeably better than during any previous month this year. During the next few weeks work will be inaugurated on a large number of buildings, principally government and school contracts, at Vancouver and in the districts adjoining, for which structural steel and all kinds of brick will be required in substantial quantities; and the prospects are that a big volume of construction will be undertaken in the residential field in May which should stimulate the market to a considerable degree. An extensive programme of municipal improvements is contemplated and this together with railroad construction under way and projected, both in outlying districts and at points quite close to the city, is calculated to effect a large increase in the demand for materials. One of the most striking signs of progress is the growing tendency to erect dwelling houses of a more substantial and permanent type than during previous years, this being attended by a healthy improvement in the enquiry for slates, brick and cement. The market for crushed stone, sand and gravel is showing every indication of becoming more active and the same applies to steel and iron. The prospects for business in paints and oils during May are reported promising and quite as favorable as for the corresponding month last year. In lumber, there is a slightly better demand than for some weeks past, but prices in most cases are below normal. Generally speaking the outlook in the constructional field is satisfactory with about the same volume of work projected, in the aggregate, as this time last year.

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55. Pkgs extra.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red and buff brick, $18; common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick, $8.60; King Edward siding, $7.50 at the yard; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18. Brick 2½ x 4 x 8½ in., blocks 3½ x 4 x 8½ in.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

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Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 65c.

MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.35 to $1.50 per bbl., f.o.b. cars, bags 10c; $1.80 l.c.l., bags extra.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—$1 per ton, car loads, on cars.

Gravel—$1.35, f.o.b. cars.

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Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft.,

(Continued on page 292)

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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"Costs Me About $10.00 per Year to Keep it in Good Repair."

No. 9 Coltrin—weight 1900 lbs.

Stillwater, Minn., Jan. 29, 1914

The Knickerbocker Company,
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Gentlemen:—

In regard to my No. 6 Coltrin Mixer, bought in April, 1908, will say: that I have been perfectly satisfied with the Mixer, and it has stood the requirements of my work very well and satisfactory. I think I am safe to say that it costs me about $10.00 per year to keep it in good repair.

Very truly yours,
Signed) ALBERT ERLITZ:

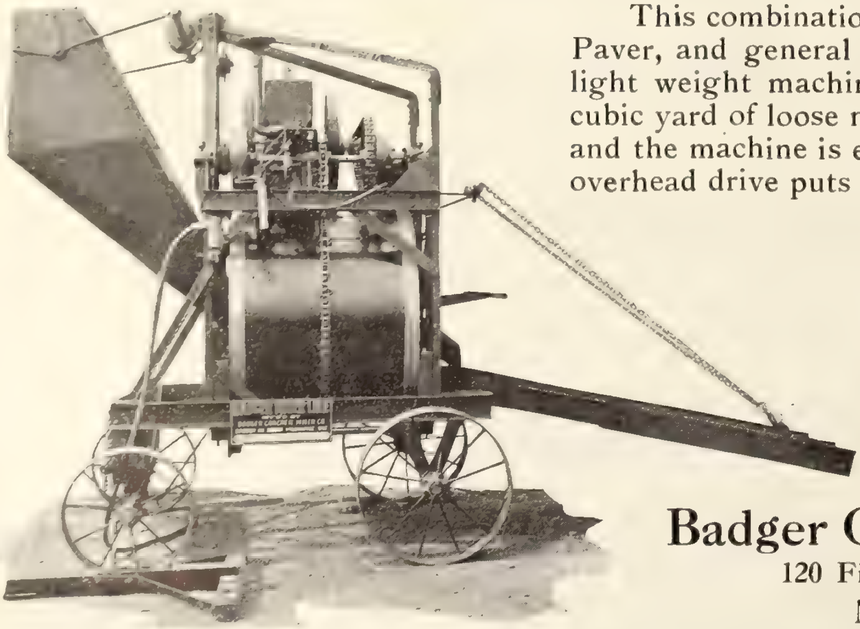
The Coltrin Continuous-Batch Mixer

Shipped anywhere on trial

For Sale by Bournival & Co., 333 Notre Dame St. East, Montreal, Que.

The Knickerbocker Co., Jackson, Mich.

Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose mixer is an all steel, light weight machine with a capacity of one half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

Write for our prices—they will interest you

Badger Concrete Mixer Co.

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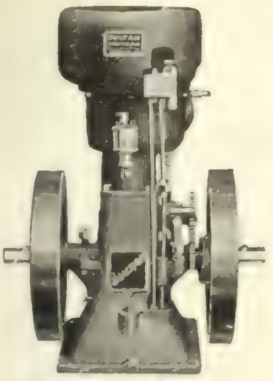
Milwaukee, Wis.



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4 Cycle, Hopper Cooled

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it is the Sure Engine for Hard Work.

The Sultan Engine is in use the world over for driving every kind of machine which operates on 10 H.P. or less. It is made in sizes from 1½ to 10 horse power and is entirely SELF CONTAINED. - HOPPER COOLED - GASOLINE IN BASE

Contractors! You can save money with the Sultan Engine.

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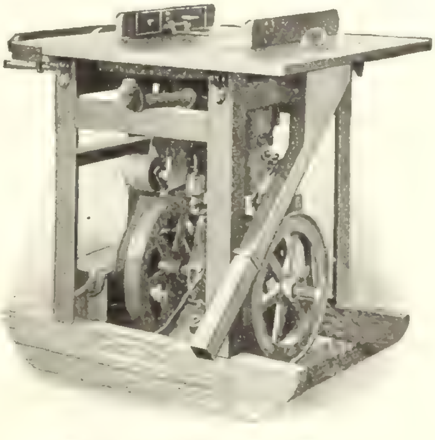

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Only Henry Disston & Sons tools used

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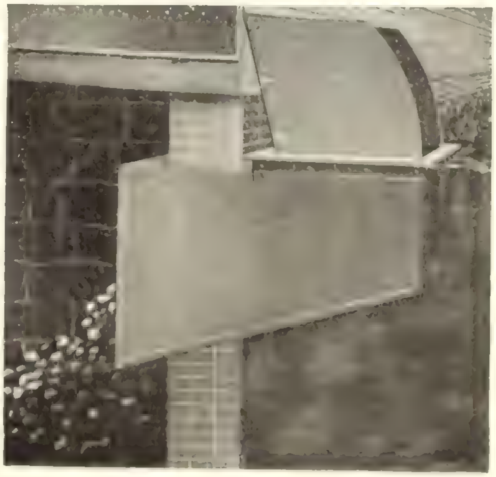


THE GRADE LINE CHUTE OPEN

Point out to your customers the following advantages of the Majestic Coal Chute and you'll effect many sales and reap a good profit.

[illegible]

Unlike a glass window it cannot be broken.

Hopper can easily be removed if desired to put in very coarse coal [illegible]

[illegible] it is burglar proof.

The door is made to lock when opened upward. It also affords protection to the building above the fuel opening where a great [illegible]

The use of the "Majestic" coal chute leaves the fuel opening always neat and clean.

The "Majestic" will give long service because it is made with a cast iron frame and a cast iron door and a steel body.

WRITE FOR FULL PARTICULARS

The Galt Stove & Furnace Co., Limited
GALT, ONTARIO

[illegible] per [illegible] ft., connecting wire in coils of [illegible], 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26 ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. Copper bearing sheets—flat, Apollo keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.50 per ton. Plaster of Paris—$2.35 per bbl. Rope—British Manilla, 15c basis per pound; second grade, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 67c per gal. of 9 lbs. Raw linseed oil—in barrels, 64c per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.25; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SUNDRIES AND SPECIALTIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

Rope—Manila, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 80c per gal. of 9 lbs.

Raw linseed oil in bbls. 78c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

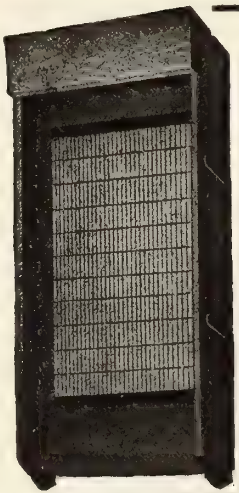
Iron Fences

Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

Send in your specifications and get our quotations.

We also specialize in iron stair work.

The GEO. B. MEADOWS
Toronto Wire Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.



NOW is the time to renew your

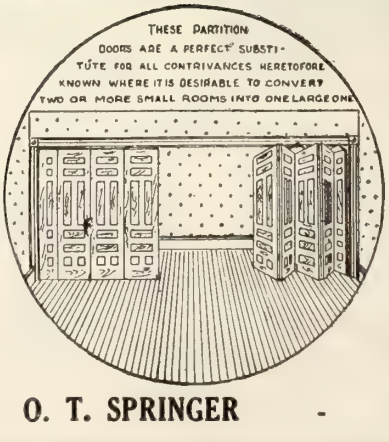
SAND and GRAVEL SCREENS

We make **SCREENS** for all purposes

Concrete Reinforcement, Window Guards, General Wire and Ironwork.

Shall be pleased to quote you.

Canada Wire & Iron Goods Co.
Hamilton


THESE PARTITION DOORS ARE A PERFECT SUBSTITUTE FOR ALL CONTRIVANCES HERETOFORE KNOWN WHERE IT IS DESIRABLE TO CONVERT TWO OR MORE SMALL ROOMS INTO ONE LARGE ONE

Points of Superiority which place

Springer's Folding Door and Partition Hanger

before all other similar contrivances

No track required on floor.
Perfect balance in all positions.
Any width of sections may be used.

Plans and full information from

O. T. SPRINGER - Burlington, Ontario

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615

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ELECTRIC STEEL CASTINGS

ES&M
BRAND
Stands for Quality

High-Grade Steel Castings of every description
Clean, sound and true to pattern
For
Bridge, Dock and Harbour Construction,
Machinery Steel Castings,
Etc., Etc., Etc.

OUR SPECIALTIES
Made under the supervision of an Expert from Sheffield, Eng.

Manganese Steel

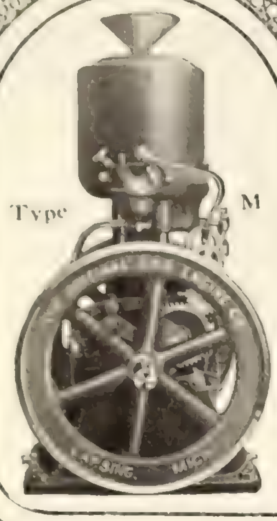
Crusher Jaws
Cheek Plates
Toggles
Granite Rolls
Ball Mill Wearing Parts
Tube Mill Wearing Parts

Wearing Parts for Gyratory Crushers, Dredger Pins and Bushes, etc., etc.

All Alloy Steel Castings, Mining Bar and Rock Drill Steel, Forging Ingots.

Write for Prices and Particulars.

THE ELECTRIC STEEL & METALS COMPANY, LTD.
Welland - - - Ontario



The power on the mixer is the most item to consider

Look it over very carefully

"Constant Service"

Consider these points:

Frost Proof — Fool Proof— Dirt Proof

Enclosed Crank Case protects the inner working parts, thus eliminating the greatest of all engine faults. No dust, dirt or cement dust can be drawn inside and wear and cut away the delicate parts.

Large Valves — Self Oiling Boxes

Here again is another big improvement and is well worth your considerations.

No Vibrations — Large Cooling Tank

All these features lend to this point simplicity, yet sturdy and compact in design, eliminating the necessity of skilled labor for operation— Doing away with all unnecessary delicate outside working parts assures you of less chance for breakdown.

Think this over if you want

"Constant Service"

on your mixer, pump or hoist use

"Ideal" Type M Engines

For contractors' uses, Ideal Hoists and Pumps

Better write for copy of complete
catalog No. 314

When buying equipment—
buy "Ideal" Power.

Contractors who want
"Constant Service"
use
"Ideal"
Power

Original Gas Engine Co.
R. E. Olds, Chairman
550 Kalamazoo St. E.
Lansing, Mich.

Get catalog
No. 314

Because Its Surfaces Have Been Waterproofed

A carpenter who finishes a room with **NEPONSET** Wall Board is doing the right thing by his customer because the surfaces of **NEPONSET** Wall Board have been thoroughly **waterproofed**. This **extra** treatment which is given to the surfaces of **NEPONSET** Wall Board is done to prevent the board from absorbing moisture.

Another point — **NEPONSET** Wall Board is beautifully finished and requires no further decoration.

To get an **attractive** as well as a **practical** job with Wall Board be sure to get

NEPONSET
WALL BOARD
FOR WALLS AND CEILINGS

Write for samples and information to

BIRD & SON

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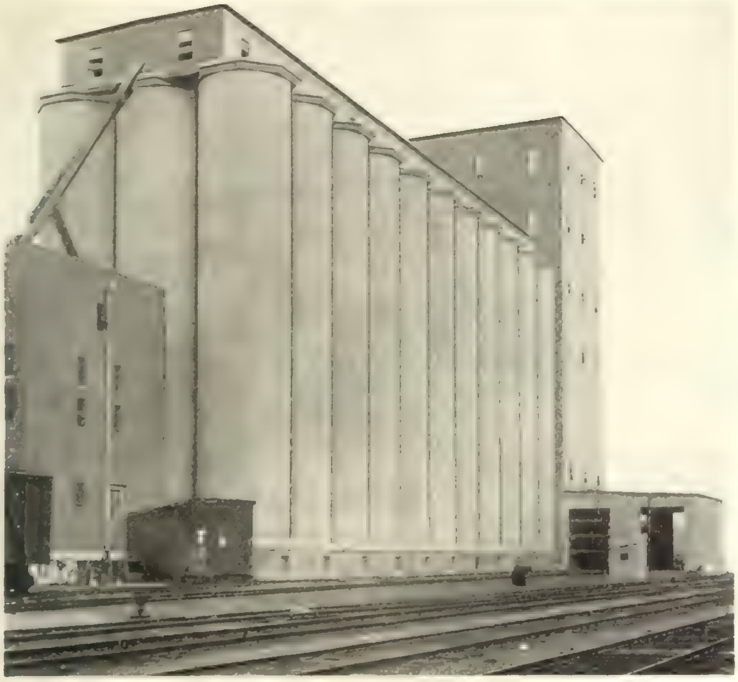
23 Heinzman Bldg., Hamilton, Ont.
MILLS:
Hamilton, Ont., and Pont Rouge, Que.
WINNIPEG, MAN. ST. JOHN, N. B.
MONTREAL, QUE. VANCOUVER, B. C.



Cement Gun

Where the Cement-Gun Earned $201.49 in One Day

for a sub-contractor. The work covered the coating of the enclosing walls of this grain elevator for a prominent railroad. Figures are based on a day when 300 sq. yards were covered. On some days as much as 350 sq. yds. were covered

HERE ARE THE FIGURES:

Price paid by the contractor to sub-contractor per square yard of surface area covered with ⅞-in. Gunite, (1 to 3 cement and sand mortar) float finish, applied on ferro-inclave furnished by contractor in place, openings not paid for, $1.05.

300 sq. yds. at $1.05 … … … … … … …		$315.00
COST OF WORK FOR DAY IN QUESTION: (300 sq. yds. covered)		
Cement and Sand … … … … … … … … … … … … … … …	$34.50	
Labor including 3 union men at $5.50 per day and 1 union engineer at $6 per day … … … … … … … … … … … … … …	38.50	
Rental on Equipment, Installation and Upkeep … … … … … … … (When you own the Cement Gun you save most of this).	33.00	
Power … … … … … … … … … … … … … … … … … …	7.51	113.51
Gross earnings of sub-contractor (Exclusive of interest and overhead)		$201.49

This building was not designed with the view of using the Cement-Gun. Had it been a saving of about 40 per cent. on the total cost of the enclosing walls would have been possible.

The above work accomplished with a single nozzle Cement-Gun.

How much will the Cement Gun save on that job of yours? You can either buy or lease a Cement Gun.

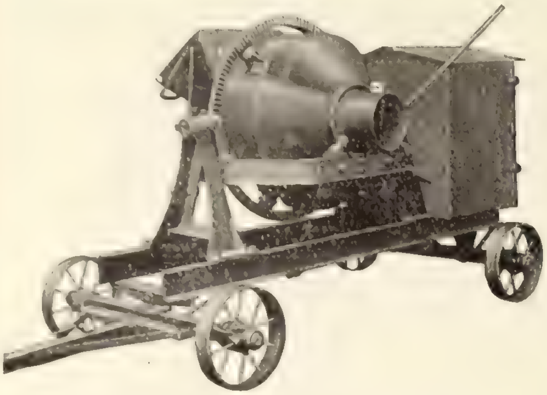
This is the way it goes on

Bulletins with complete escription of the Cement-Gun illustrated with photographs of some of the important work which it has accomplished will be mailed you on request.

Cement-Gun Company, Inc.

Exclusive Sales Agents for
the Dominion of Canada
30 Church Street
New York City

This Cement Gun did the above work



We are Agents for the "CLOVERLEAF MIXERS AND HOISTS"

The **Mixing Action is as unique as it is effective—it's not a** matter of spilling from one place to another, and taking the chance that every particle is involved sooner or later—**unlike other Mixers,** it subjects the entire mass to a **complete mixing** every time the drum makes a complete revolution. All the material is turned, doubled, kneaded and pressed until the **entire mass** is homogeneous.

With the "Involute Curve" drum, you **don't have to pound** or chisel the drum—with no wings, buckets, or sharp outward angles, there's nothing to pocket the material, and the drum can be **scoured out instantly**—NO OTHER MIXER IS SO EASY to KEEP CLEAN.

If interested write for Catalog and Prices.

THE STRATFORD MFG. CO., LTD. - STRATFORD, ONT.

SAFETY COMFORT DURABILITY GOOD APPEARANCE

NOTE THE

Asbestoslate Roof

It combines all those good qualities, and furthermore is remarkably easy to put on. Asbestoslate Shingles are cement and asbestos permanently combined into a tile which hardens and improves with age.

Public buildings all over Canada have been roofed with Asbestoslate. Montreal West, the garden suburb of Canada's metropolis, is almost entirely roofed with Asbestoslate—in every case the roof has given that entire satisfaction which should lead you to use it for your own building.

These fire proof, weather proof shingles may be had in Scotch Grey, Indian Red or Blue Black to suit the building and surroundings. If you are in the market for roofing send at once for further information—our booklet, "The Town of Asbestoslate," gives full particulars and illustrates the class of building owned by the man who endorses the Asbestoslate roof. Write for it to Dept. C. R.

Asbestos Manufacturing Company, Limited

Address: E. T. Bank Building, 263 St. James St., MONTREAL. - Factory at Lachine, P. Q.

E. LAURIE CO.

E. LAURIE, M. E. C. M. WARD, C. E.

243 Bleury St., MONTREAL

Selling Agents, Province of Quebec for

DECARIE INCINERATOR CO.
Garbage and Refuse Disposal Plants

THE WEBER CHIMNEY CO.
Reinforced Concrete Chimneys

CHICAGO PUMP CO.
Vertical, Motor Driven Sewage Ejectors
Sump Pumps

WRITE FOR ESTIMATES AND CATALOGS

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

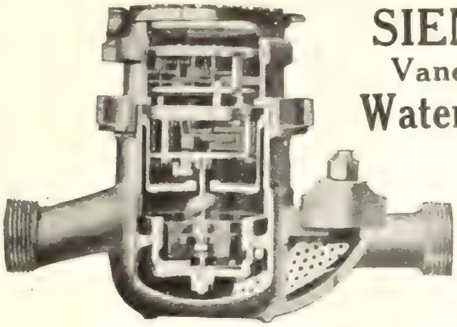
Neptune Meter Co.

Manufacturers of the well-known

TRIDENT
Frost-Proof
Water
Meters

Write for Catalogue

Main Office - 90 West Street
New York City



SIEMENS
Vane Wheel
Water Meters

Dry
Running
Type

The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

Literature on request.

Siemens Company of Canada
LIMITED
Head Office: Transportation Building
Toronto MONTREAL Winnipeg

BELL AND SPIGOT
STEEL PIPE

COATED AND WRAPPED

Made in sizes from 2" to 10" inside diameter with different thicknesses for varying pressures.

PAGE-HERSEY
Iron, Tube & Lead Co., Limited
TORONTO, ONT.

Service

We have unequalled facilities
for making prompt ship-
ments and can guar-
antee deliveries
to date.

Our line of bricks comprises

RED PRESSED BRICK
RED WIRE-CUT BRICK
RED RUFFESTRY BRICK
FLASHED PRESSED BRICK
FUSED PRESSED BRICK

Write us for samples and prices

Russell Shale Bricks, Ltd.
RUSSELL, ONT.

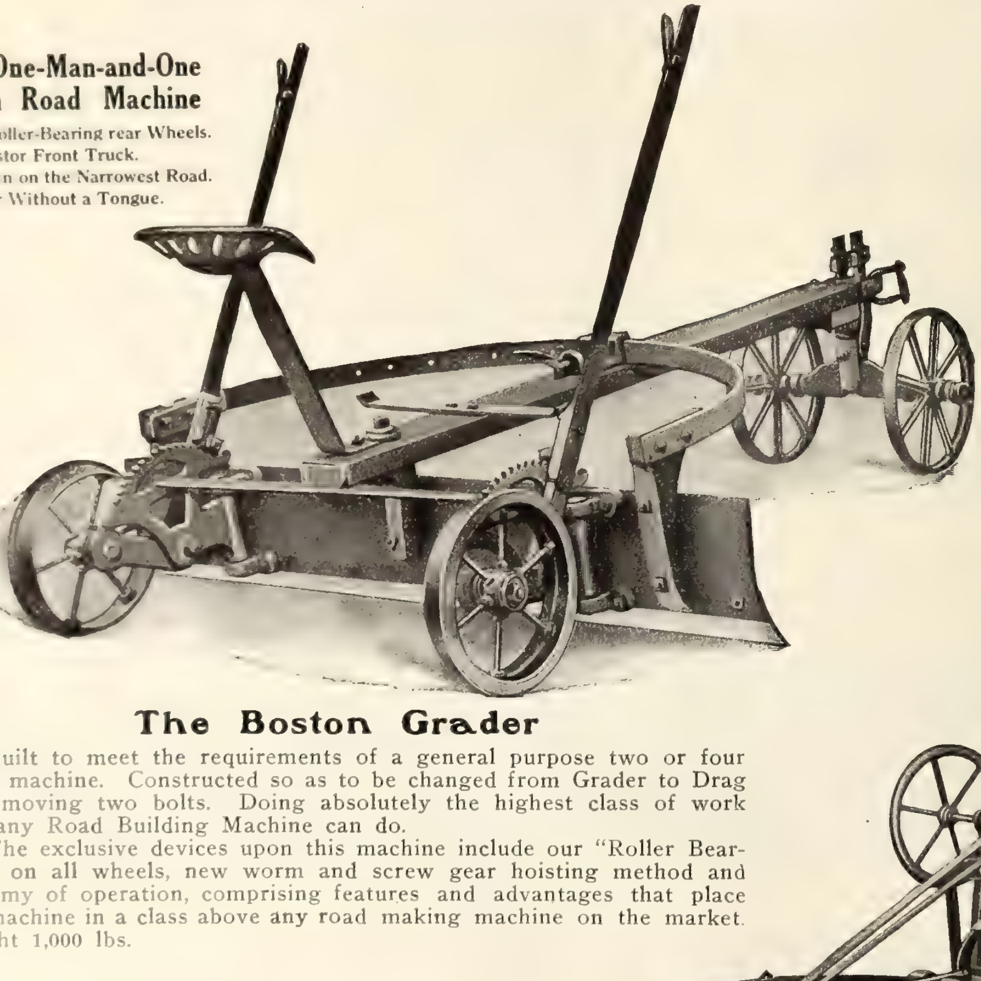
The "PANAMA" Line of
ROAD MACHINERY

These two pages simply illustrate a few of the lines of Road Machinery and Culvert Pipe that we manufacture, and that in engineering and practical efficiency, is worthy of its namesake. "Panama" products are simply designed and built to accomplish their purpose directly and give the greatest length of satisfactory service. Everyone who uses such appliances will find greatest economy in the use of our guaranteed products.

"Panama Junior Improved" Grader and Leveller

The-One-Man-and-One Team Road Machine

With Roller-Bearing rear Wheels.
Has Castor Front Truck.
Will turn on the Narrowest Road.
With or Without a Tongue.



A road maintainer that has no equal for saving labor and money—used by county commissioners, township trustees, by cities for light street work, by individual farmers and by contractors. Strong and easy of operation for both man and team. Is reversible and adjustable. The blade is of high carbon steel. Has curved moldboard. Can be worked with or without a tongue. A great machine where a number are required.

Of Special Interest to Contractors

It has no equal for spreading crushed stone or gravel on the road bed, and will save you dollars on this class of work.

Mold-board is 6 ft. long, to which is attached a cutting blade 6 inches wide. Combined width is 13 inches.

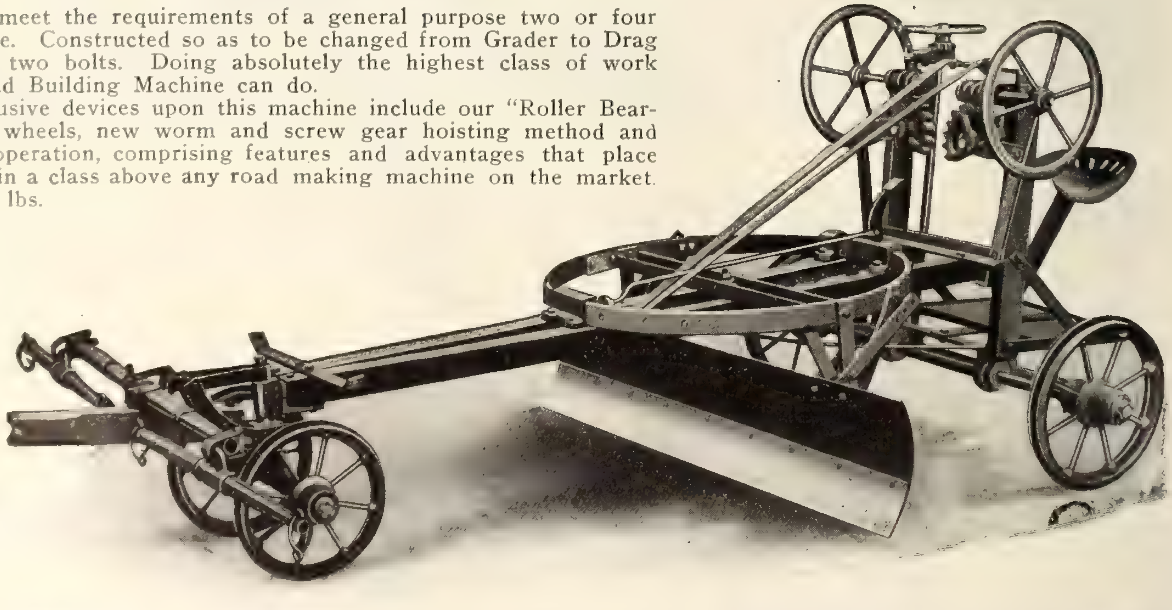
Rear wheels 16 inches high, with flanges. Front wheels are 16 inches high. Wheel base 7 feet. Weight 600 lbs.

The Boston Grader

Built to meet the requirements of a general purpose two or four horse machine. Constructed so as to be changed from Grader to Drag by removing two bolts. Doing absolutely the highest class of work that any Road Building Machine can do.

The exclusive devices upon this machine include our "Roller Bearings" on all wheels, new worm and screw gear hoisting method and economy of operation, comprising features and advantages that place this machine in a class above any road making machine on the market. Weight 1,000 lbs.

WRITE
FOR
OUR
ILLUSTRATED
CATALOGS



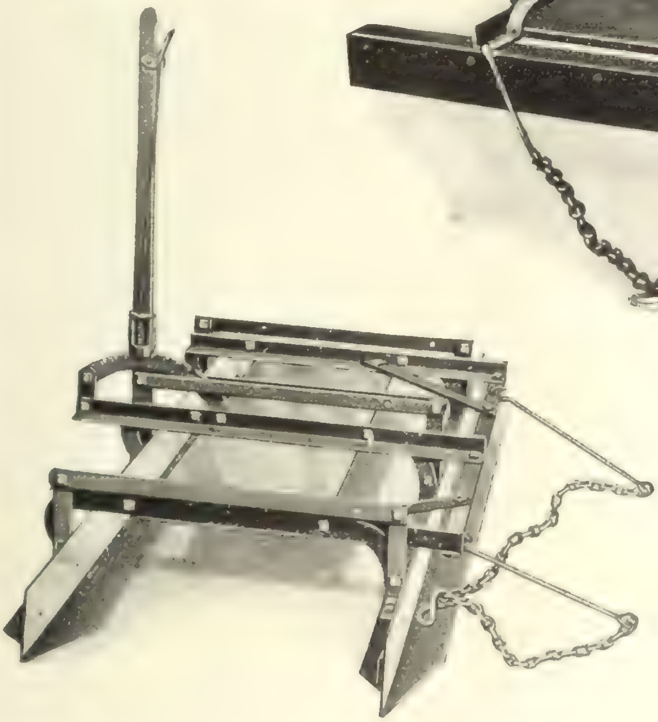
The Exeter Manufacturing Company, Limited,
EXETER, ONT.

Manufacturers of the "PANAMA" line of Road Graders, Road Drags, and Culvert Pipes; the "Leader" line of Cement Block, Brick and Tile Machinery; the "Exeter" Farm, Church and School Bells.

The "PANAMA" LINE of
ROAD MACHINERY

"Panama Simplex" Road Drag

"Panama Township Winner" Drag



The simplest form of an efficient road drag, priced low enough to compete with plank drags and of far greater service. The best materials are used. By turning over upon the curved runners it is moved from place to place with ease. 7 feet long; weight 250 lbs.

Our 1914 Model has all Steel Top, blades are detachable, and saw blades can be replaced at small cost. Drag is equipped with a strong chain and fair length.

This drag has a number of features not found in any other drag. It has interchangeable and reversible blades, flexible all-steel frame, adjustable hitch and steel top.

The low hinge joint on this drag makes it possible for the operator to adjust the blades while the machine is in motion.

When using any of our drags for heavy work that would cause machine to skid, we recommend the use of our Anti-Skidding Truck, which is attached with a long hitch to the rear of the machine, having a seat directly over the wheels, which makes the flange very effective. This truck can be adjusted to any angle and will positively prevent any drag from skidding away from the work.

This attachment, while not shown on the cut appearing herewith, is fully illustrated in our catalogue.

The Lines We Manufacture

Panama List of Road Machinery

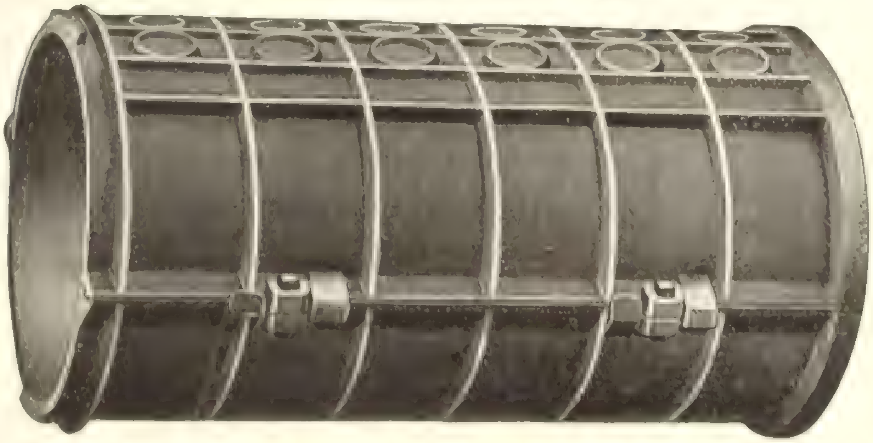
Landslide Grader, 1600 lbs.
Boston Grader, 1000 lbs.
Panama Junior Improved Grader, 600 lbs.
Three-Way Drag, 650 lbs.
"Township Winner" Drag, 350 lbs.
Panama No. 1. Road Drag, 325 lbs.
Panama No. 2 Road Drag, 275 lbs.
Panama Simplex Drag, 250 lbs.
Panama Wheeled Scrapers.
Panama Drag Scraper.
Panama Portable Crane

"Leader" Line of Concrete Machinery

Leader Cement Block Machine.
Triumph Cement Block Machine.
[illegible]
Full Line of Forms and Moulds for Ornamental Concrete Work.

Church, School, Fire and Farm Bells
The only bell foundry in Canada.
Garden and Contractors' Barrows

"Panama Round" Culvert Pipe



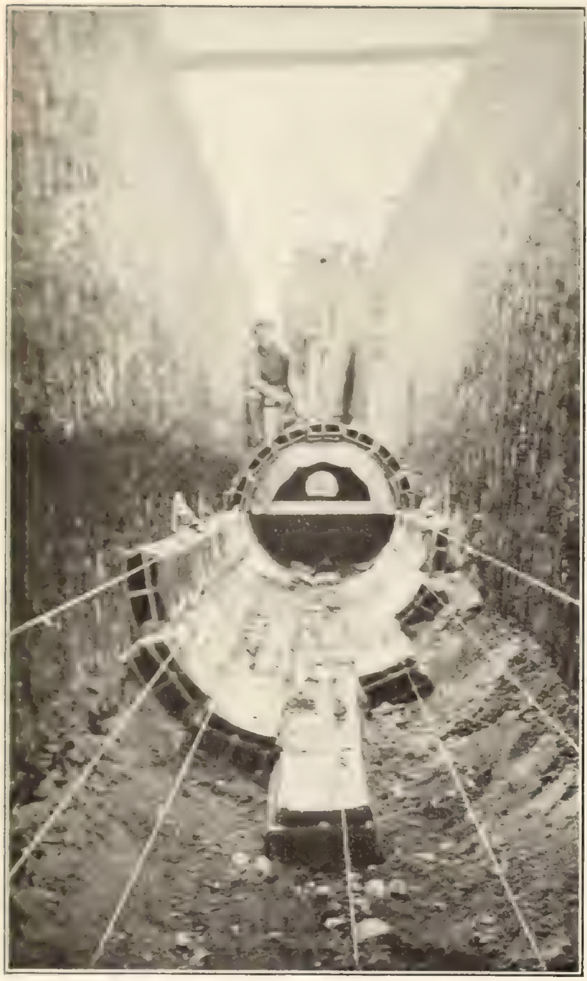
All the features of ordinary [illegible]

This is the feature that should be of great interest to engineers and municipalities in [illegible]

[illegible]

WRITE FOR OUR ILLUSTRATED CATALOG

THE EXETER MANUFACTURING CO., LIMITED, - - Exeter, Ont.



A Few Vitrified Segment Sewer Block Installations

The following cities represent a few of the Segment Block installations which have been made. Read this list over and write to the engineer in the city located nearest to you. Have him tell you his opinion. Is this the kind of evidence you want? We have more—write for it.

New York City
Cleveland, Ohio
Baltimore, Md.
Detroit, Mich.
Indianapolis, Ind.
Louisville, Ky.
Atlanta, Ga.
Springfield, Ohio.
Wheeling, W. Va.
Columbus, Ohio
Cumberland, Md.
Covington, Ky.
Calgary, Alta., Can.
Akron, Ohio
Lorain, Ohio
Albert Lea, Minn.
Amsterdam, N.Y.
Ashbury Park, N.J.
Ashtabula, Ohio
Assiniboia, Man., Can.
Bucyrus, Ohio
Boone, Pa.
Barberton, Ohio
Black Diamond, Pa.
Bluefield, W. Va.
Boston, Mass.
Chicago Jct., Ohio
Coatsville, Pa.
Concord, N.H.
Crosswell, Mich.
Cudahy, Wis.
Dowagiac, Mich.
Edgewater, Pa.
Elkins, W. Va.
Edmonton, Alta., Can.
Evansville, Ind.
Fitchburg, Mass.
Flint, Mich.
Frankfort, Ind.
Follansbee, W. Va.
Girard, Ohio
Green Bay, Wis.
Hanover, Pa.
Hartford, Conn.
Holyoke, Mass.
Kent, Ohio
Kenmore, Ohio
Ligonier, Ind.
Mansfield, Ohio
Mantua, Ohio
Marion, Ohio
Marshall, Mich.
Monessen, Pa.
McKees Rocks, Pa.
New Albany, Ind.
New Bedford, Mass.
Newberry, Pa.
New Kensington, Pa.
New Rochelle, N.Y.
Boro of Brooklyn
Norwalk, Ohio
Ogdensburg, N.Y.
Oswego, N.Y.
Point Grey, B.C., Can.
Portland, Me.
Quebec, P.Q.
Ravenna, Ohio
Regina, Sask., Can.
Rockwood, Pa.
Schenectady, N.Y.
Sioux City, Ia.
South Bend, Ind.
Superior, Wis.
Toledo, Ohio.
Toronto, Ont.
Torrington, Conn.
Uniontown, Pa.
Wallingford, Conn.
Wachussett, Mass.
Wapakoneta, Ohio
Washington, Pa.
Waterville, Me.
White Plains, N.Y.
Williamsport, Pa.
Weston, W. Va.
Winnipeg, Can.
Woodlawn Cemetery, N.Y.
Wooster, Ohio
Yorkville, Ohio

Watch this list grow—then you're bound to know!
FOR PARTICULARS ADDRESS

VITRIFIED CLAYS LIMITED
CALGARY, ALBERTA

Mast Screws or Turnbuckles

27 Styles. Sizes 3/16 to 2", and in lengths from 2" to 72"

Drain and Ship Pumps

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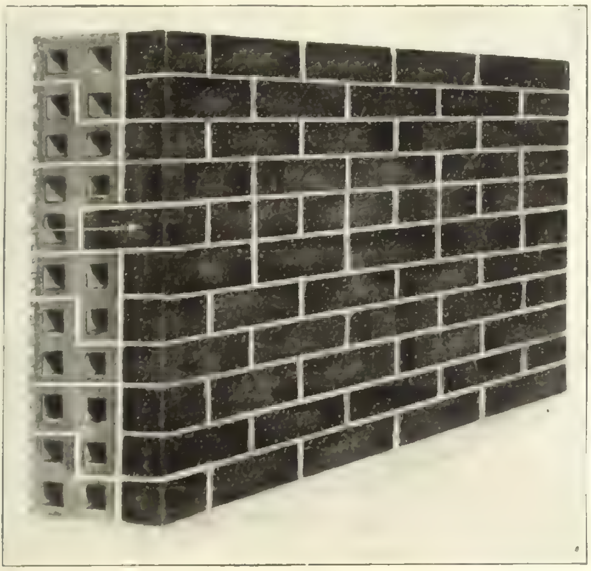

Fig. 1

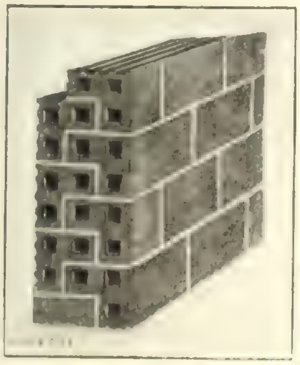

Fig. 2

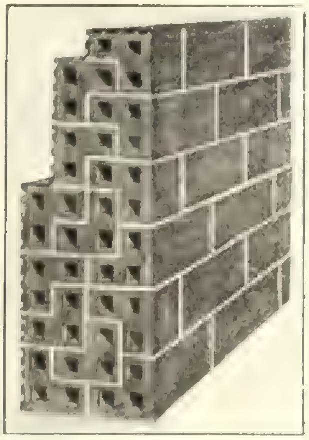

Fig. 3

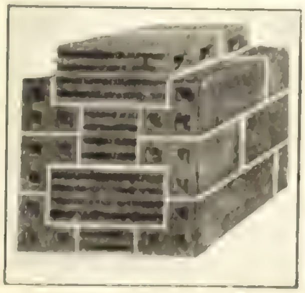

Fig. 4

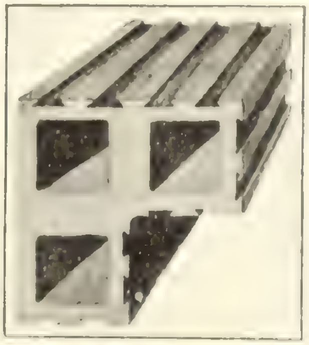

Fig. 5

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Write to-day

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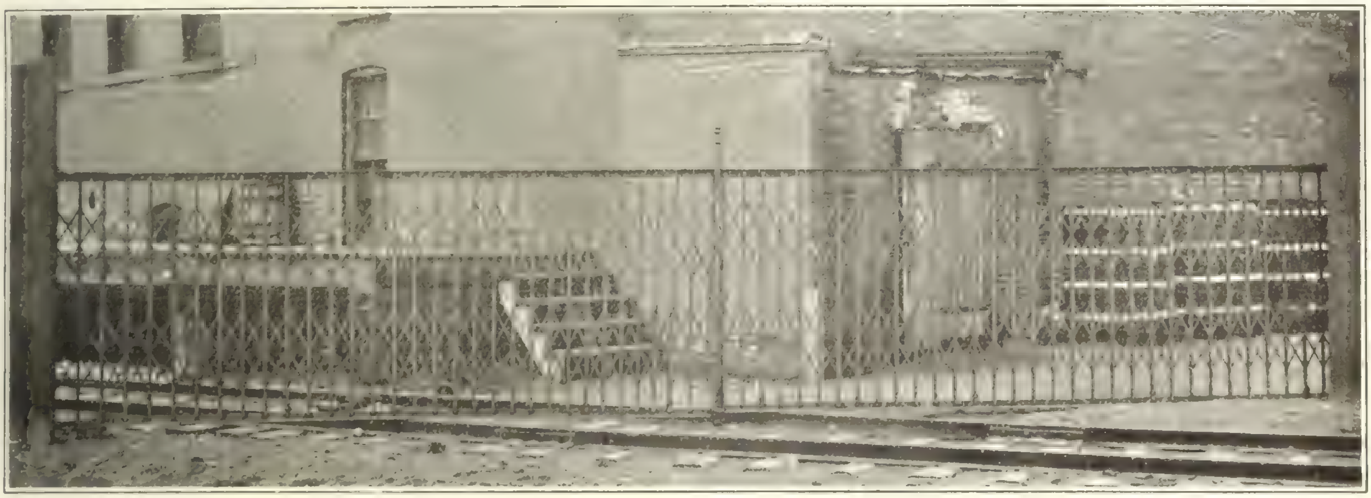
STEEL GATES



WE have here illustrated one of "Aikenheads Improved Type Collapsible Steel Gates" installed at Wm. Davies Co. Limited, works, Toronto. This gate 37 feet wide by 7 feet high in two leaves, each leaf arranged to collapse behind fence. The remainder of gate is made portable.

Gate can be collapsed and moveable portions taken away in 35 seconds and a clear opening left to allow freight to pass through.

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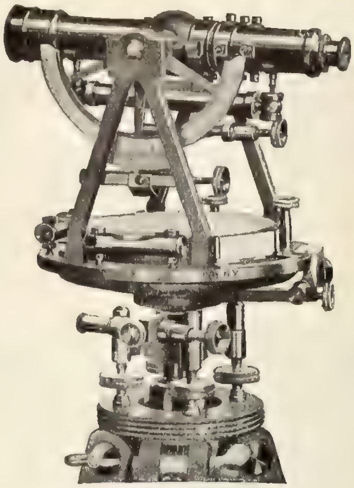

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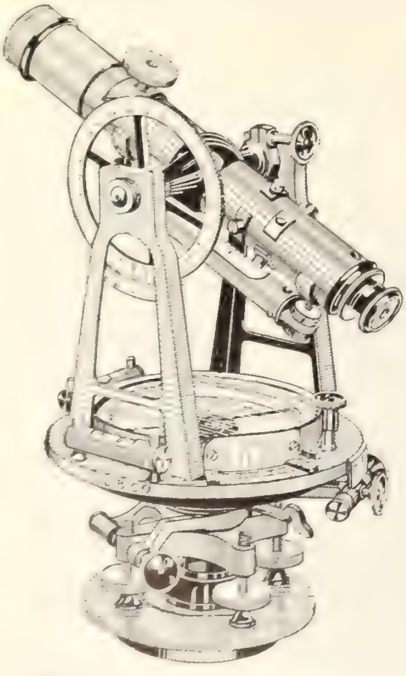

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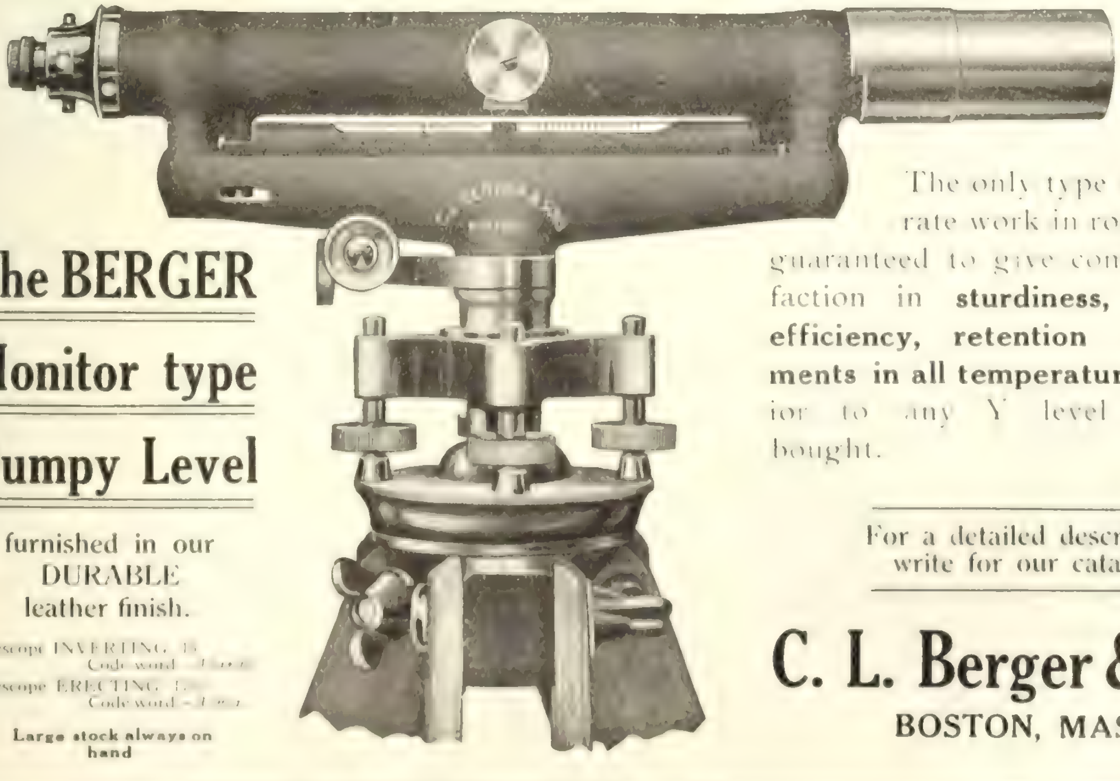

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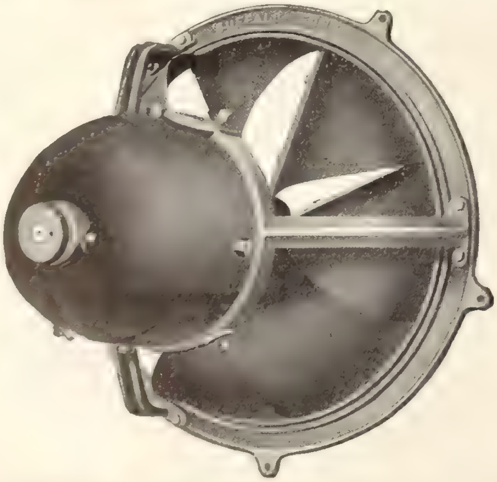

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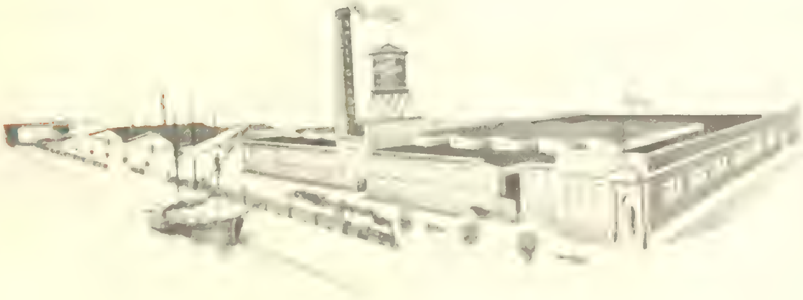

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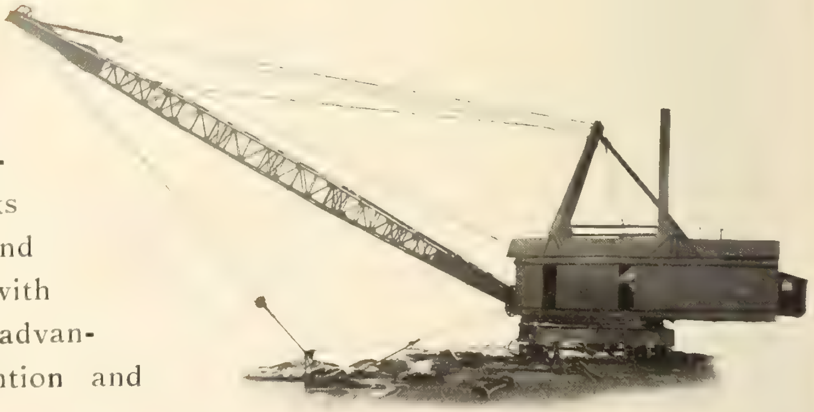

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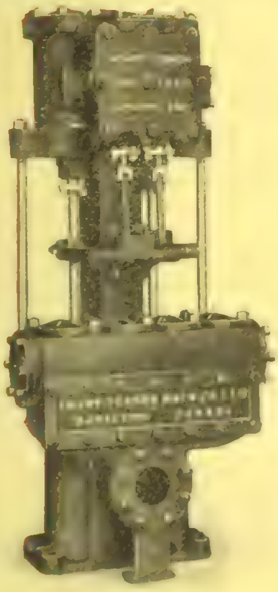

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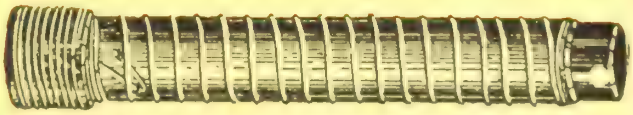

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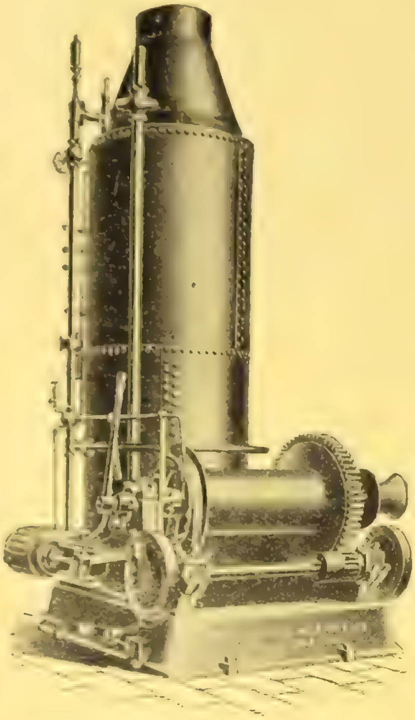

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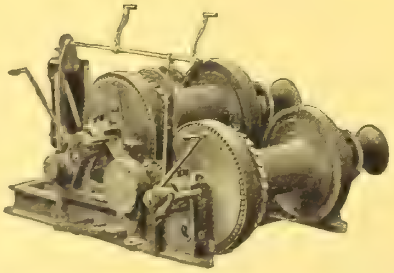

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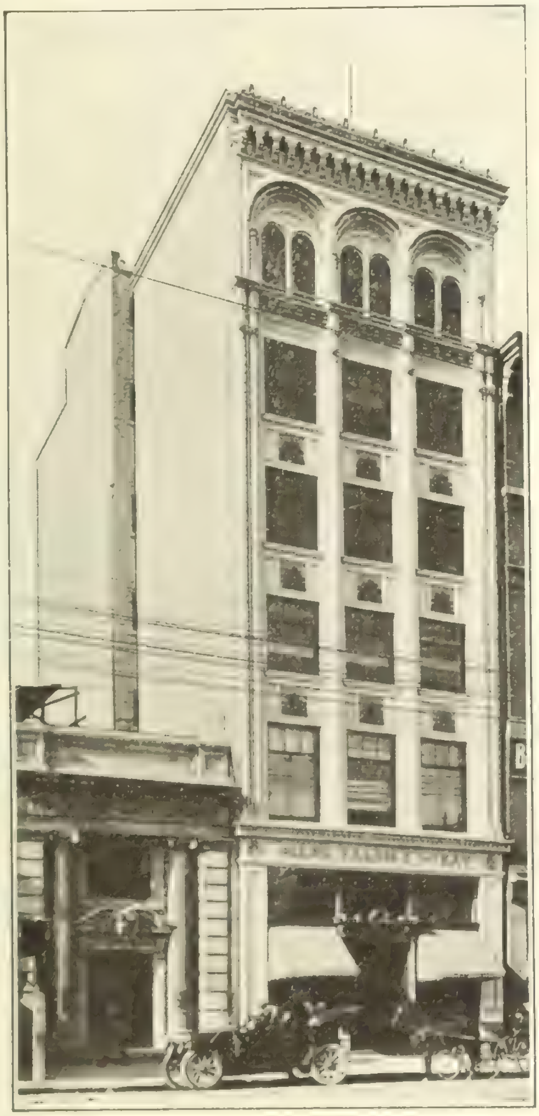

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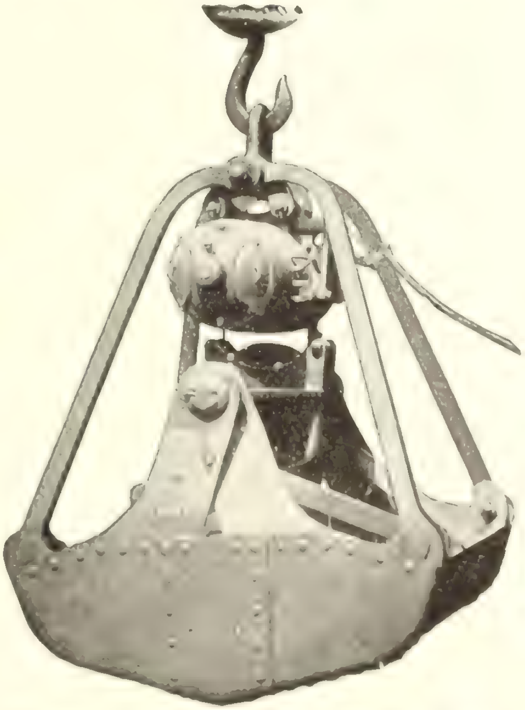

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Bremner, Alex.
Canada Cement Co.
McNally & Co., W.
Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Rogers, Alfred, Limited
Smyth & Ryan

Cement Coating
Dougall Varnish Company
Wadsworth Howland Co.

Cement Mill Machinery
Hull Iron & Steel Foundries
Sutcliffe, Speakman & Co.

Cement Tools
Abram Cement Tool Co.
Wettlaufer Bros.

Chain
McKinnon Chain Co.

Chain Blocks
Can. Yale & Towne Limited.
Morris Crane & Hoist Co., Herbert.

Coal Chutes
Galt Stove & Furnace Co.
Manitoba Bridge & Iron Works

Coal Handling Apparatus
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Weller Mfg. Co.

Concrete Mixers and Appliances
Austin Drainage Excavator Company, F. C.
Canadian Allis-Chalmers, Ltd.
Canadian Concrete Appliance Co.
Hopkins & Co., F. H.
Jaeger Machine Company.
Koehring Machine Co.
Knickerbocker Co.
Lecky & Collis
London Concrete Machinery Co.
Marsh Capron Company.
Mills Bros.
Municipal Engineering & Contracting Co.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.
Wettlaufer Bros.

Contractors
Anglins Limited
Eastern Pipe Construction Co.
Foundation Company, Limited
Reggin & Spence
Wells & Gray.

Contractors' Plant & Supplies
American Hoist & Derrick Co.
Austin Drainage Excavator Company, F. C.
Barber Asphalt Paving Co.
Bateman Wilkinson Co.
Beatty & Sons, M.
Browning Company
Canadian Allis-Chalmers, Ltd.
Can. Billings & Spencer
Canadian Fairbanks-Morse Co.
Canadian Locomotive Company
Canadian Brakeshoe Co., Ltd.
Canadian Concrete Appliance Co.
Central Locomotive & Car Works
Dake Engine Co.
Dominion Lime Company.
Dore & Fils
Dull Co., Raymond W.
Erie Iron Works
General Car & Mach. Works.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Hepburn & Co., J. T.
Honig & Mock.
Hopkins & Co., F. H.
Jaeger Machine Company.
Koehring Machine Co.
Lecky & Collis
Marsh & Henthorn
McKinnon Chain Co.
Mills Bros.
Morris Machine Works.
Municipal Engineering & Contracting Co.
Montreal Locomotive Works
Mussens Limited
Parsons Company, G. W.
Royce Limited
Sauerman Bros.
Schell Foundry & Machine Co.
Stinson-Reeb Builders' Supply Co.
Sudbury Construction & Machinery Co.
Stratford Mfg. Company
Tiffin Wagon Works.
Wettlaufer Bros.

Controlling Altitude Valves
Golden Anderson Valve Co.

Conduits
Can. H. W. Johns-Manville Co.
Conduits Co., Limited
Orpen Conduit Mfg. Co. of Can.
Ric-Wil Underground Pipe Covering Co.

Contractors' Barrows
Erie Iron Works
Meaford Wheelbarrow Co.

Contractors' Flare Lights
Sudbury Construction & Machinery Co.

Conveying Machinery
Dull Co., Raymond W
Goodwin, Barsby & Co.
Sturtevant Co. of Can. Ltd. B. F.
Sutcliffe, Speakman & Co.
Weller Mfg. Company

Core Drills
Can. Ingersoll-Rand Co., Ltd.

Corrugated Iron
Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Ormsby, A. B., Limited
Pedlar People Limited.

Cranes, Travelling and Locomotive
American Hoist & Derrick Co.
W. D. Beath & Son
Browning Company.
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.
Northern Crane Works.
Rock & Power Machinery, Ltd.
Roelofson Elevator Works.
Royce Limited

Creosote Stains
Cabot, Inc., Samuel

Crushed Stone and Granite
Hagersville Contracting Co.
Ontario Lime Co., Ltd.
Rogers Supply Company
Smyth & Ryan

Crushers (Stone and Rock)
Canadian Allis-Chalmers, Ltd.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Hopkins & Co., F. H.
Jenckes Machine Co.
Lecky & Collis
London Concrete Machinery Co.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.
Wettlaufer Bros.

Culverts
Pedlar People.

Cupolas (Foundry)
Northern Crane works

Cylinders for Liquified Gases
Mannesmann Tube Co.

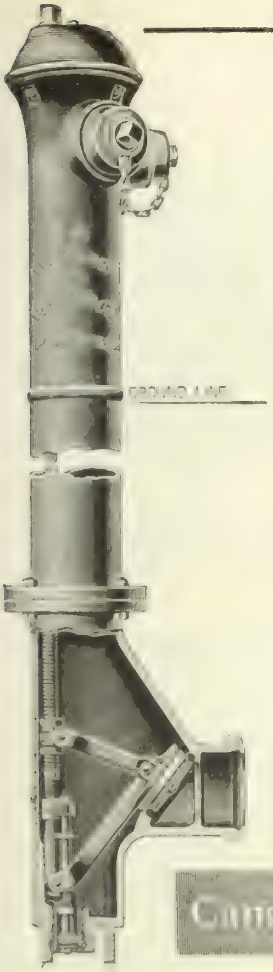
Derricks and Derrick Fittings.
American Hoist & Derrick Co.
Beath & Son, W. D.
Hepburn, John T.
Sasgen Derrick Company

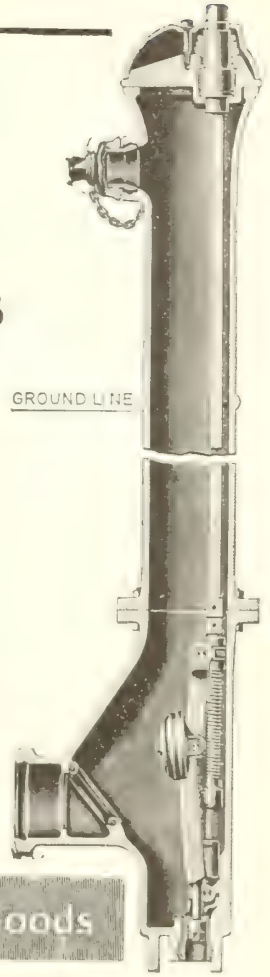
Dredges
Beatty & Sons, M.
Browning Company.
Morris Machine Works.

Drills
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis
Star Expansion Bolt Co.

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 10)





Don't Buy Hydrants by the Pound

See that you get a hydrant which comes the nearest to eliminating all loss of pressure between the hose and the main.

Pratt and Cady Hydrants

Have a free waterway from the main to the hose coupling, and will deliver a solid stream of water to the hose, operating rod is located on one side and the valve is raised out of the way when the hydrant is opened.

Absolutely self-draining when properly installed, there is no necessity for frost cases.

You owe it to your taxpayers or stockholders to investigate the merits of the Pratt & Cady hydrants before placing your order.

Write now for full information.

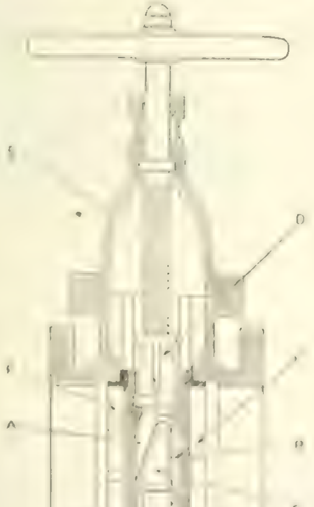
Fairbank's "Double Parallel Disc" gate valves for water works will appeal to all discerning buyers.

The Canadian Fairbanks - Morse Co., Limited

Montreal Toronto
Quebec Ottawa
St. John Hamilton
Ft. William
Winnipeg Calgary
Regina Edmonton
Saskatoon Vancouver
Victoria

Canada's Departmental House for Mechanical Goods

Fairbanks Water Works Valves

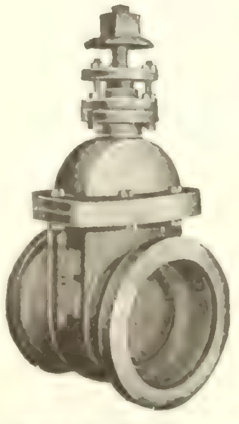


Fairbanks Double Disc Iron Body Gate Valves are particularly adapted to water works installations.

The mechanism permits valves of very staunch and compact design without a clumsy appearance, and offers unique advantages for the renewal of parts with minimum trouble and expense. Ease of operation and absolute freedom from danger of the wedge becoming stuck are valuable features, and the elimination of friction between the bearing surfaces of the wedge faces and seat rings materially increases the durability of these Valves.

The [illegible] mechanism is a simple one, simple in construction, and all wearing parts are fully brass mounted.

We are prepared to quote on valves, pipe and fittings for your complete installation and will gladly do so on receip of blue prints and specifications.



[illegible]
Hub End Gate Valves,
Hydrants, Valve Boxes,
Indicator Posts, Fittings,
Pipe, Check Valves.

The Canadian Fairbanks - Morse Co., Limited

Montreal Toronto
Quebec Ottawa
St. John Hamilton
Ft. William
Winnipeg Calgary
Regina Edmonton
Saskatoon Vancouver
Victoria

Canada's Departmental House for Mechanical Goods

For the Small Cost on the Big Haul

For that continuous saving of 50 to 80 per cent in haulage cost, for that 5c per ton mile service, there is but one answer—Troy Reversibles and a Tractor. Over 250 Troy trains have proved it—are proving it **today** and **now**. Over all sorts of roads and grades—under all kinds of conditions they are taking the place of teams and hauling anything from crushed stone to cast iron pipe (the latter on platform trucks) at a saving never less than 50 per cent. Think what that means on your big job.

Troy Reversibles

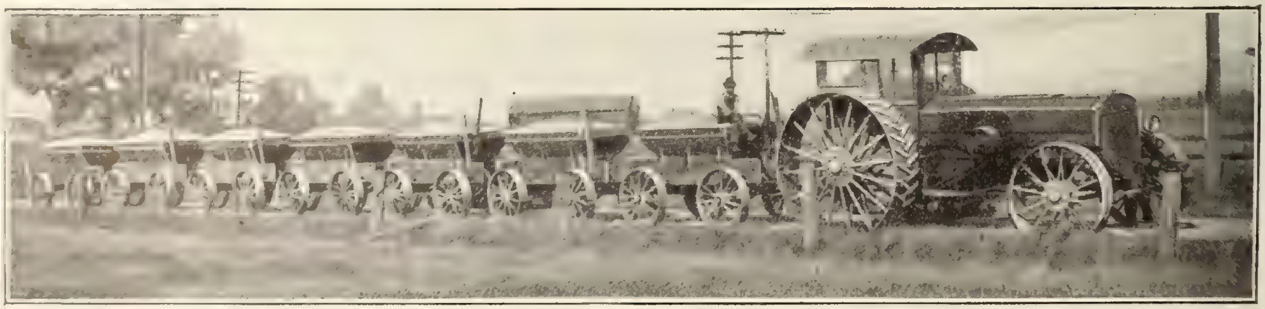
are not limited to road-building work—they give the same economical service on any big hauling job. Reversible dumpers—Reversible spreaders, or Reversible platform trucks carry any and all types of material—and carry it with the same 50 to 80 per cent saving.

And to prove it. we'll send you the exact figures (compiled by users) that show how Troy Reversibles are handling materials at from 4c. to never more than 10c. per ton mile.

Note what these concerns have accomplished—and compare their records with your own. If you haul for profit, you'll investigate the Troy.

Our Hauling Book N. R. tells the whole story—just ask us for it.

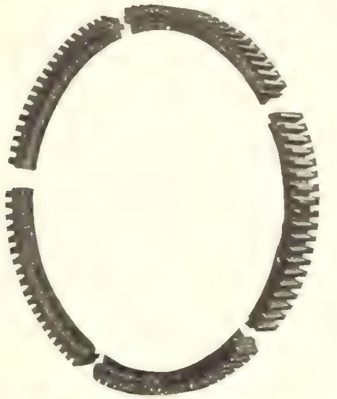
The Troy Wagon Works Co., Race and Walnut Streets, Troy, Ohio



If a Mixer is built with Parts like These, it will stand up on ANY job

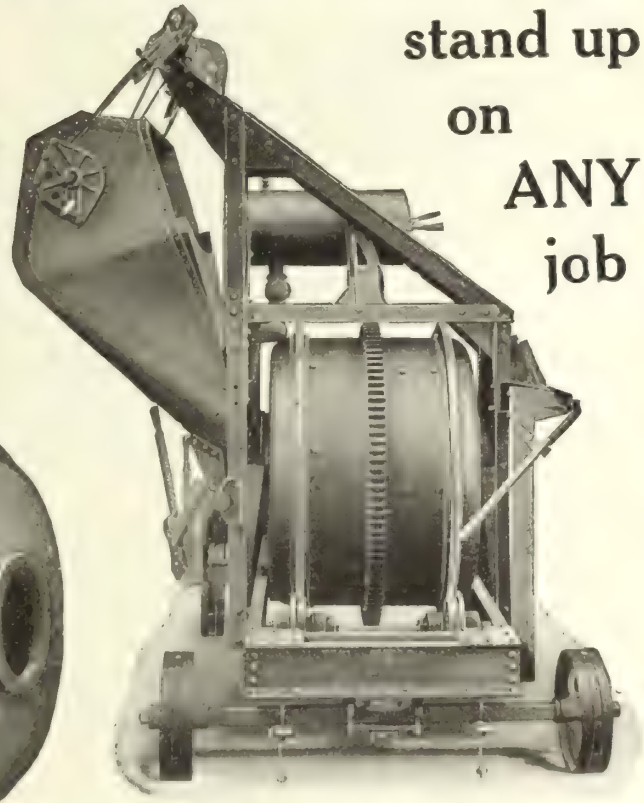
All-Steel Rail Tracks.

The M-C is the only mixer fitted with real railroad tracks around the drum. These rail tracks are of standard rolled steel sections. They run true and wear four or five times as long as cast-iron rings.



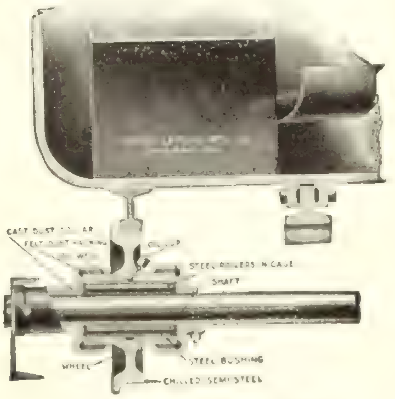
Segmental Drum Gear.

The M-C is the only mixer in which the main drum gear is built in segments bolted in place, to facilitate making repairs. If you have ever had trouble with a solid gear ring you will appreciate the advantages of this feature.



Cast Semi-Steel Drum.

[illegible] steel of great strength and toughness which offers maximum resistance to the severe scouring action of the sand and stone. A drum like this, more than half an inch thick, wears three or [illegible] drum ⅛-inch thick.

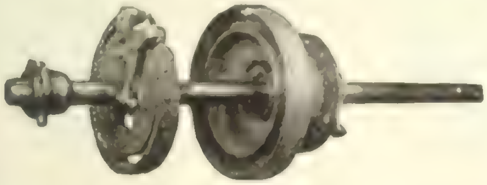


Detail of Roller-Bearing Wheels.

on which the M-C Rail Tracks roll. These wheels are of extra large diameter, are made of chilled semi-steel and are of the same type as used on cars in extremely severe mining service. They have heavy flange on one side, insuring straight, true turning of the drum regardless of its load.

The M-C
THE RAIL TRACK

Most Mixing—Least Fixing



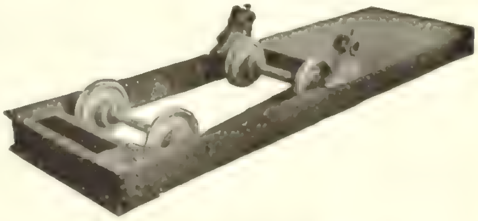
M-C Friction Clutch.

The M-C is the only mixer using the steel band-lined-with-wood-blocks type of friction [illegible]

Discharge Half of Drum

[illegible] the discharge spout and any batch is completely [illegible]

Is The Only Mixer With The Exclusive Features Illustrated



Heavy Steel Channel Frame.

held square by steel plates. No twisting or binding of this frame is possible, so the true [illegible]

Charging Half of Drum.

Highly developed, practical, proven arrangement of heavy steel mixing blades insures thor[illegible]

Ask the Man who uses The M-C Mixer—he knows

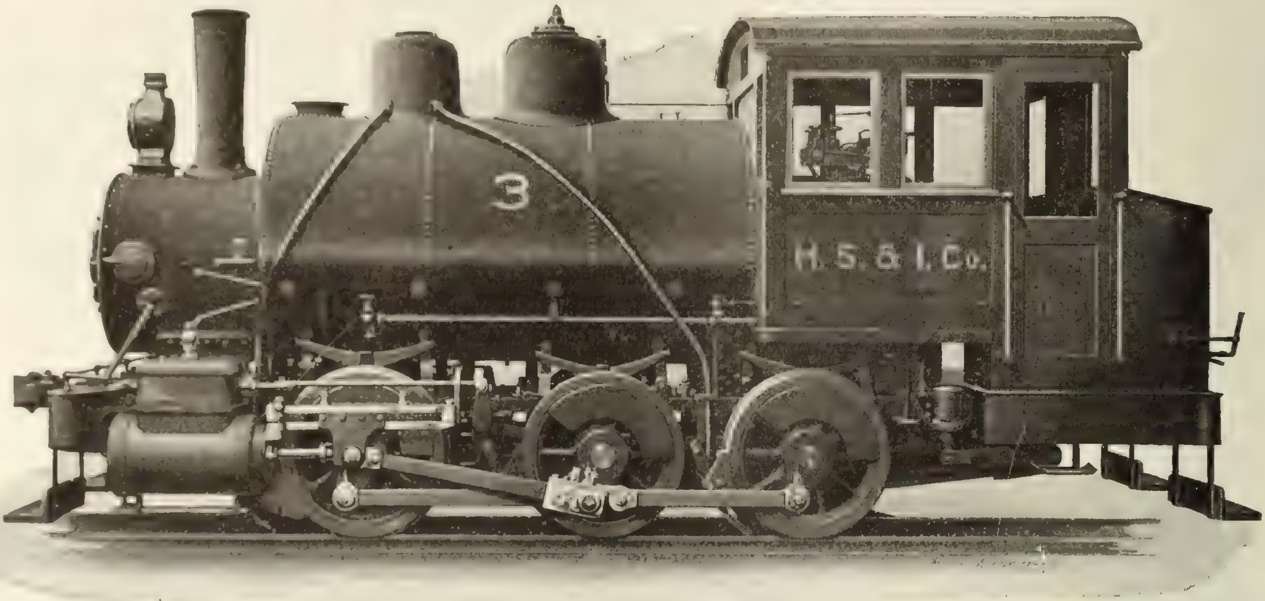
CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

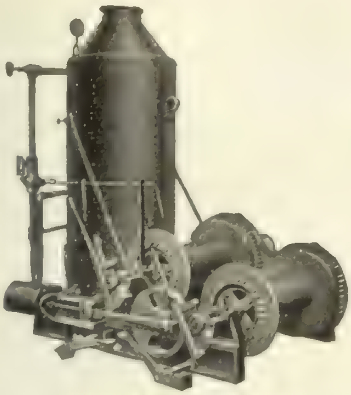
VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names in Mind when Ordering High Grade Brick.

- **Beaver Clay Mfg. Co.**
- **Columbus Brick and Terra Cotta Co.**
- **Hydraulic-Press Brick Co.**
- **Hocking Valley Fire Clay Co.**
- **Kushequa Brick Co.**
- **Ohio Mining & Mfg. Co.**
- **Pearl Clay Products Co.**
- **Tiffany Enameled Brick Co.**

BLACK BUILDING SUPPLY CO., LTD. - TORONTO



Standard Hoisting Engine

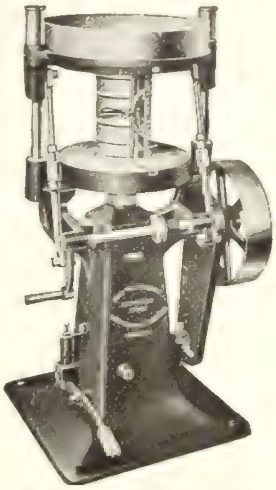
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur, Ont.—Northern Agency Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

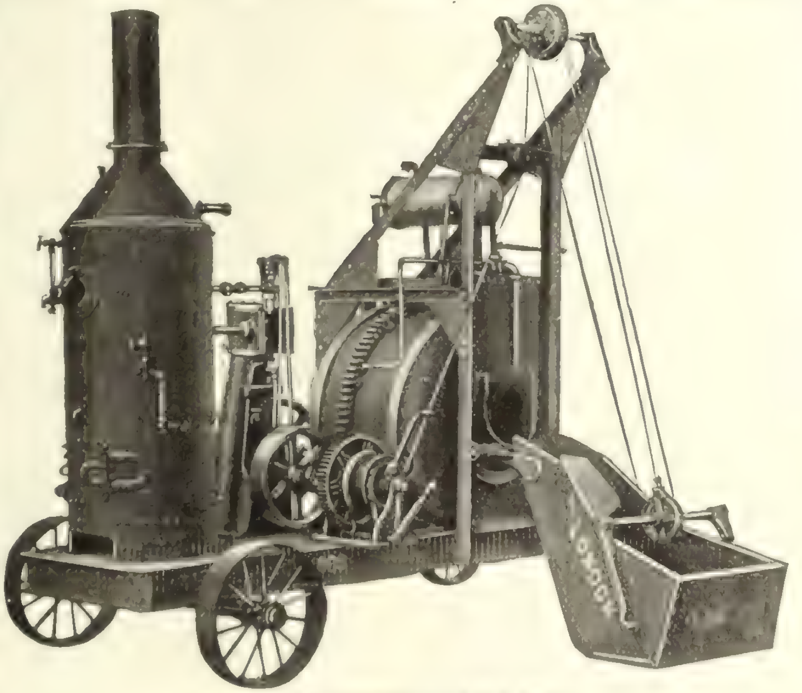
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

—

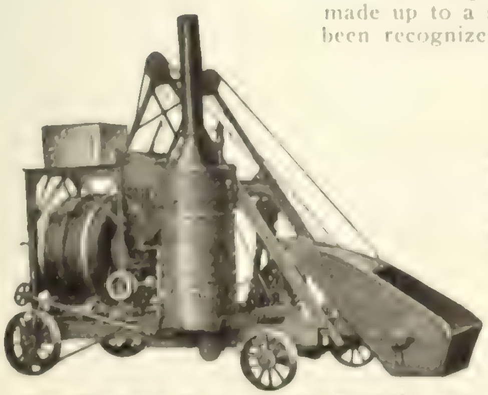
Pumping Outfits

—

Hoists and Derricks

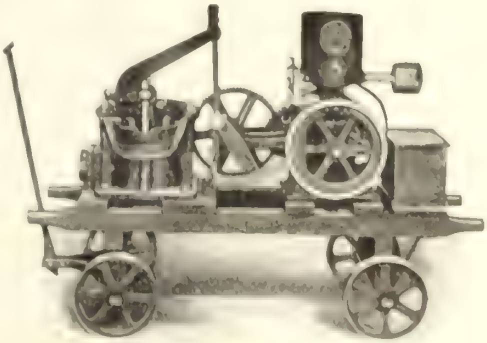
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader

Correspondence Solicited.



Diaphragm Pump with Power

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Drop Forgings
- Canadian Billings & Spencer, Ltd

Dump Cars, Wheels, etc.
- [illegible] Limited
- Manitoba Bridge & Iron Works
- Sorel Foundry & Machine Co.
- Western Wheeled Scraper Co.
- Weller Mfg. Co
- Sheldons Limited

Dump Carts and Wagons
- Deere Plow Co., John.
- Troy Wagon Works

Drying Apparatus
- Sturtevant Co. of Can. Ltd. B. F.

Electric Fans
- Sturtevant Co. of Can. Ltd. B. F.

Electric Air Rock Drills
- Canadian Ingersoll-Rand Co.

Electric Steel Castings
- Electric Steel & Metals Co.

Elevators
- Roelofson Elevator Works.

Enamelled Brick
- American Enamelled Brick & Tile Company
- National Builders' Supply & Enamel Concrete Brick Co.

Engines
- Boving Company of Canada
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Inglis Co., John
- Jenckes Machine Co.
- Laurie & Lamb
- Leonard & Sons, E.
- McDougall Caledonian Iron Wks.
- Mussens Limited
- Rock & Power Machinery
- Waterous Engine Works Co.
- Wettlaufer Bros.

Engineers (Civil and Mechanical)
- Aird Murray & Lowes
- Bowman & Connor
- Campbell, R.
- Chipman & Power
- Dominion Engineering & Inspection Company.
- Farmer, John T.
- Galt Engineering Co., John
- Lea & Ferguson
- Mitchell, C. H.
- Thorold Co., F. W.
- Tyrrell, H. G.

Excavators
- Austin Drainage Excavator Company, F. C.
- Brown Hoisting Machinery Co.
- Municipal Engineering & Contracting Company.
- Parsons Company, G. W.

Exhaust Heads
- Canadian Buffalo Forge Co.
- Sheldons Limited

Expansion Bolts
- Star Expansion Bolt Co.

Expanded Metal
- Mannesmann Tube Co.
- Pedlar People Limited.

Fans
- Canadian Sirocco Co.
- Sheldons Limited.
- Sturtevant Co. of Can. Ltd. B. F.

Fuel Economizers
- Sturtevant Co. of Can. Ltd. B. F.

Electrical Machinery and Supplies
- Ferranti Electrical Co.
- Sturtevant Co. of Can. Ltd. B. F.

Field Instruments
- Gurley, W. & L. E.

Filters
- American Water Softener Co.

Fire Brick
- Elk Fire Brick Co.
- Ontario Lime Co., Ltd.
- Smyth & Ryan

Fire Escapes
- Manitoba Bridge & Iron Works.
- McGregor & McIntyre

Fireproof Doors and Windows
- Feather & Roadhouse
- Hope & Sons, Henry.
- Mussens Limited
- Pedlar People Limited.
- Steel & Radiation Limited

Fuse (Safety Blasting)
- Lecky & Collis

Fixtures (Gas)
- Consumers Gas Co.

Floor and Wall Tile
- Frontenac Floor & Wall Tile Co.

Folding Doors
- Springer, O. T.

Forges
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Canadian Sirocco Co.

Forgings
- Canadian Billings & Spencer, Ltd

Gas Engines
- Armstrong Mfg. Co.
- British Mfrs. Assn. of Canada.

Gasoline Engines
- Armstrong Mfg. Co.
- Mills Bros.
- Original Gas Engine Co.
- Wettlaufer Bros.

Glass
- Consolidated Glass Co.
- Excelsior Plate Glass Co.
- Hobbs Mfg. Co.
- Luxfer Prism Co.
- Pilkington Bros.
- Toronto Plate Glass Imp't'g Co

Gravel Washing Plants
- Dull Co., Raymond W.

Hammer Drills
- Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
- Boving Company of Canada
- Escher Wyss & Co.
- Mannesmann Tube Company.
- Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
- American Hoist & Derrick Co
- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
- Morris Hoist & Crane Co., Herbert.
- Mussens Limited
- Rock & Power Machinery
- Royce Limited
- Sturtevant Co. of Can. Ltd., B. F

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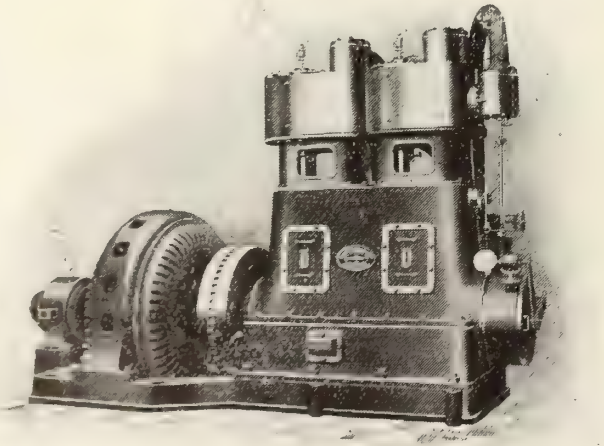


BRUCE PEEBLES

Alternators and Generators

are built suitable for belt-drive or for direct coupling to any form of prime mover.

Send Us Your Enquiries

Peebles-Browett Alternator Set

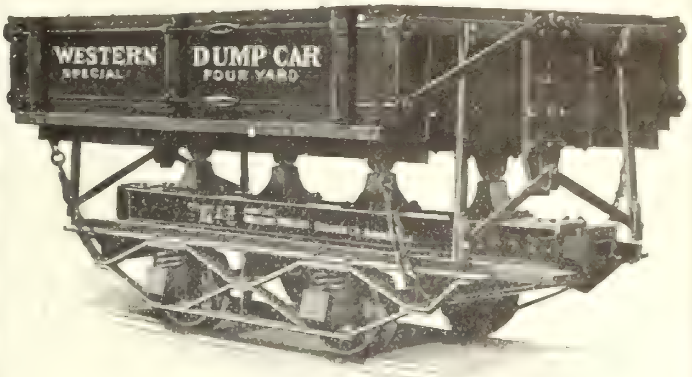
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM" TOOLS
It is plain to be seen you are losing money

Abram Cement Tool Co.,
Windsor, Ontario



The Western Four-Yard Car

by reason of its strength at every point of resistance, [illegible] petition.

The sterling qualities of the Western Standard 4-yard Car are responsible for its high standing with men engaged in the handling of earth and stone. Many thousands of these cars have been sold and are used on the most important earth moving projects of the age.

The Western Special 4-yard Car, our most recent product, is designed for even harder service than the Standard Car, and we urge those desirous of securing cars of great strength to make a careful examination of this car.

Western Wheeled Scraper Co.

AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited

Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Heating Apparatus
- Canadian Buffalo Forge Co
- Canadian Sirocco Co.
- Sheldons Limited

Hoists
- Roelofson Elevator Works
- Northern Crane Works.
- [illegible] Mfg. Company

Hoisting Engines
- Canadian Allis-Chalmers, Ltd
- Canadian Fairbanks-Morse Co.
- Wettlaufer Bros.

Hydrants
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

Industrial Cars
- Central Locomotive & Car Works

Insulating Compounds
- Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
- Batts Limited
- Canada Office & School Fur. Co.
- Rhodes Curry & Co.

Jib Cranes (all kinds)
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Kilns
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.
- Canadian Sirocco Co.
- Berg Machinery Mfg. Co.

Lime
- Dominion Lime Company.
- Jamieson Lime Co.
- Ontario Lime Co., Ltd.
- Standard White Lime Co.

Lighting and Pumping Installations
- Lister & Co., Ltd., R. A.

Locks
- Can. Yale & Towne Ltd.

Locomotives
- Boving Company of Canada
- Central Locomotive & Car Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Locomotive Company
- Montreal Locomotive Works
- F. H. Hopkins Co.
- Mussens Limited

Metal (Anti-Corrosive)
- Stark Rolling Mill Co.

Metal Lath
- Greening Wire Co., B.
- Metallic Roofing Co.
- Noble, C. W.
- Pedlar People Limited.
- Steel & Radiation Ltd

Meters, Electrical
- Siemens Co. of Canada, Ltd.
- Ferranti Electrical Mfg. Co.
- Canadian Allis-Chalmers, Ltd.

Mechanical Draft Apparatus
- Sturtevant Co. of Can. Ltd. B. F.

Meters, Water
- Hopkins & Co., F. H.
- McDougall Caledonian Iron Wks
- Neptune Meter Co.

Overhead Runways
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Paints and Varnishes
- Dominion Paint Works
- Hopkins & Co., F. H.

Paving and Paving Materials
- Asphalt & Supply Co.
- Aztec Oil Asphalt Co
- Bessemer Limestone Co.
- Baker Co., R. D.
- Barber Asphalt Paving Co.
- Dominion Creosoting Company
- Dunn Wire-Cut-Lug Brick Co.
- Ontario Asphalt Block Co.
- Paterson Mfg. Co., B.

Pipe (Concrete, Iron and Wood)
- American Spiral Pipe Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Pipe Co.
- Dominion Concrete Co.
- Gartshore-Thomson Pipe Co.
- Gerald Lomer, Ltd.
- Mannesmann Tube Company.
- National Concrete Mfg. Co.
- National Iron Works
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(Continued on page 18)

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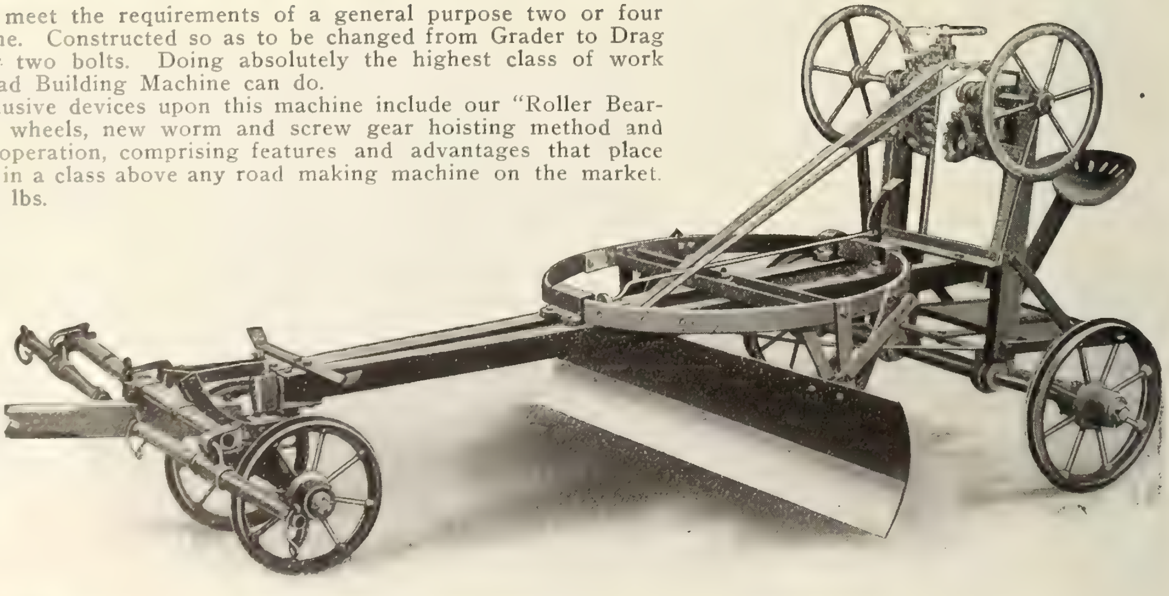
Built to meet the requirements of a general purpose two or four horse machine. Constructed so as to be changed from Grader to Drag by removing two bolts. Doing absolutely the highest class of work that any Road Building Machine can do.

The exclusive devices upon this machine include our "Roller Bearings" on all wheels, new worm and screw gear hoisting method and economy of operation, comprising features and advantages that place this machine in a class above any road making machine on the market. Weight 1,000 lbs.



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All Sizes

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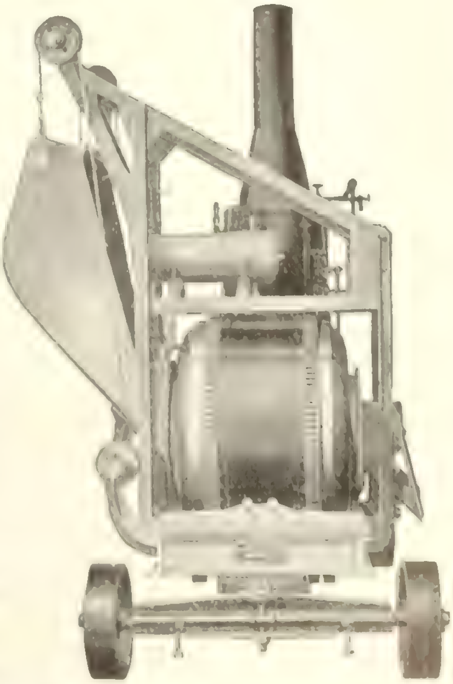

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THE better the building, the more certain that it will have a Barrett Specification Roof, because first-class buildings are the work of first-class architects and engineers and they know the relative values of the different types of roofing.

They know that a Barrett Specification Roof consists of five layers of Specification Felt cemented together with continuous layers of Specification Pitch, with a top surface of slag or gravel. It is built on the roof without the narrow joints or laps of tin or ready roofing.

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A copy of The Barrett Specification will be sent, on request, to any architect, engineer or property owner. It formulates a precise and practical way of laying these roofs to secure the best results at the least expense. Address our nearest office.

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We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

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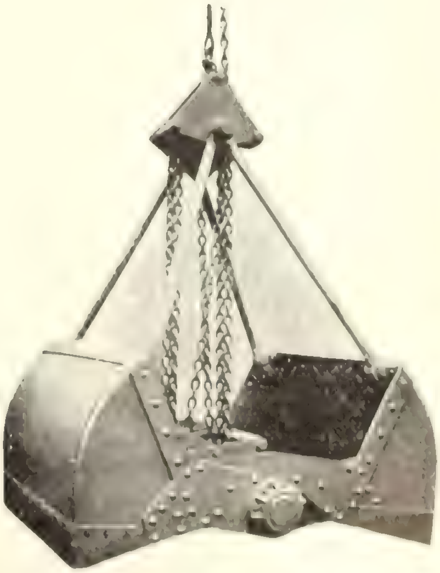

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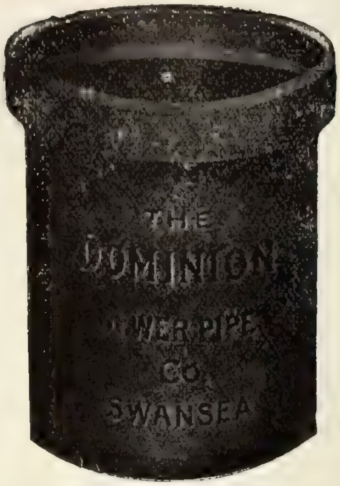

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With proper facilities for removing material from shovel promptly, large outputs can be handled with a Type O Thew.

The results secured on the work shown in the cut are interesting.

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Contract—Grand Rapids and Northwestern R.R.

Date	Size of Cars	Cars Loaded	Cu. Yds.
April 1st	1½ cu. yd.	490	612
April 2nd	1½ cu. yd.	595	744
April 3rd	1½ cu. yd.	550	687
April 4th	1½ cu. yd.	575	719
April 6th	1½ cu. yd.	375	469
April 7th	1½ cu. yd.	500	625
April 8th	1½ cu. yd.	175	219
April 9th	1½ cu. yd.	520	650
April 10th	1½ cu. yd.	370	462
April 11th	1½ cu. yd.	640	800
April 13th	1½ cu. yd.	556	695
April 14th	1½ cu. yd.	495	619
April 15th	1½ cu. yd.	393	491
April 17th	1½ cu. yd.	714	892
April 18th	1½ cu. yd.	560	700
April 20th	1½ cu. yd.	275	344
April 21st	1½ cu. yd.	510	637
April 22nd	1½ cu. yd.	525	656
April 23rd	1½ cu. yd.	555	693
April 24th	1½ cu. yd.	525	656
April 28th	1½ cu. yd.	165	206
April 29th	1½ cu. yd.	215	269
April 30th	1½ cu. yd.	350	437
Total 23 days		10,628	13,282
Average per 10-hour day		462	578

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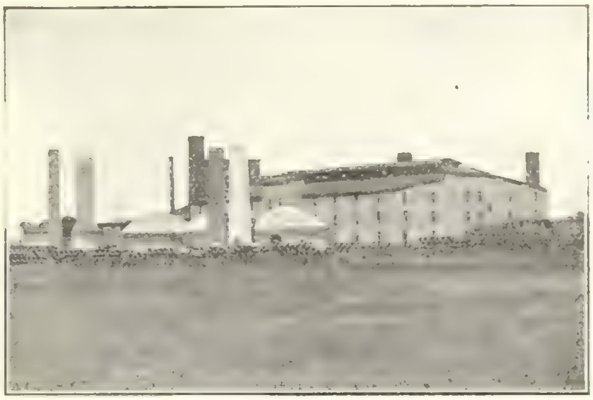
The Thew Automatic Shovel Company, - Lorain, Ohio

Front view—Plant No. 3, New Glasgow, N.S.



Back view—Plant No. 3, New Glasgow, N.S.

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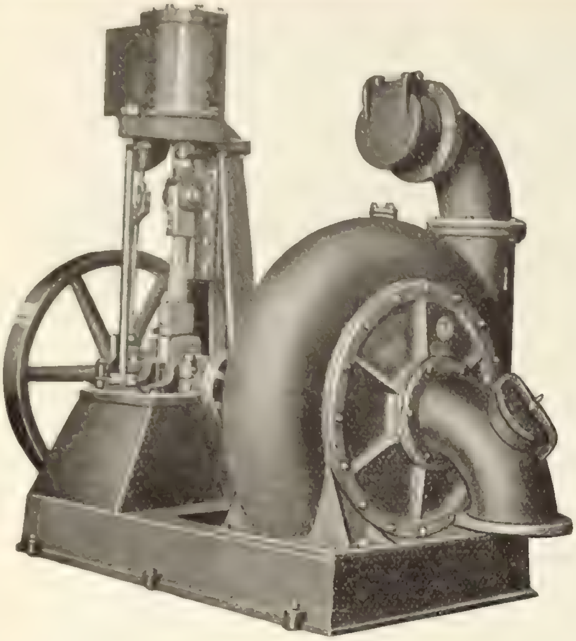

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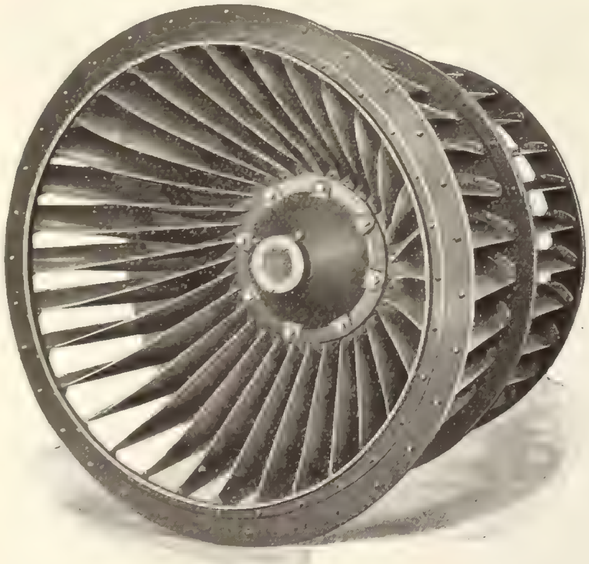

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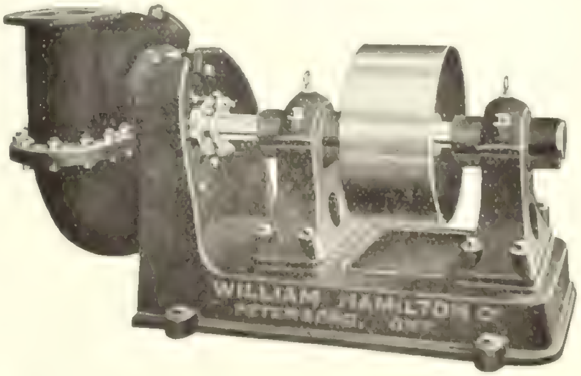

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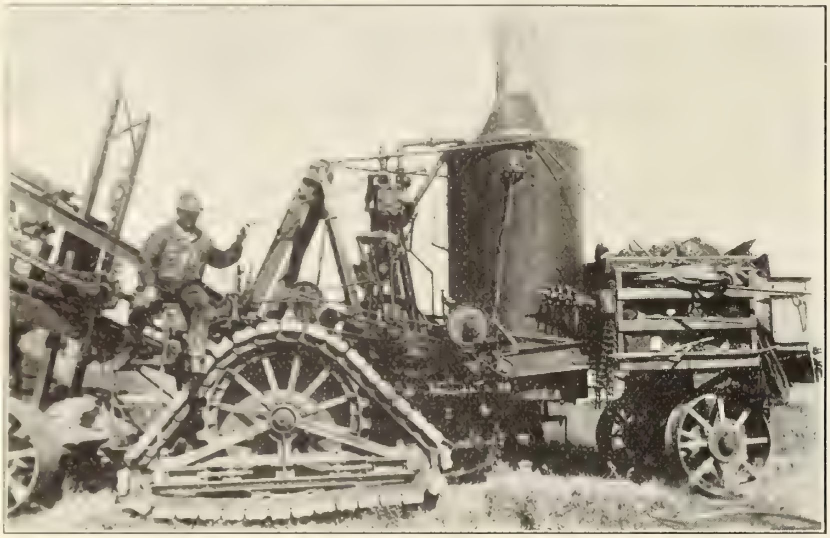

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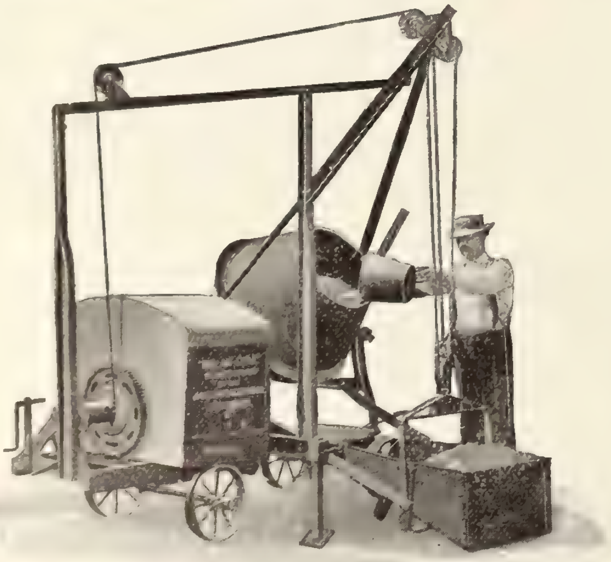

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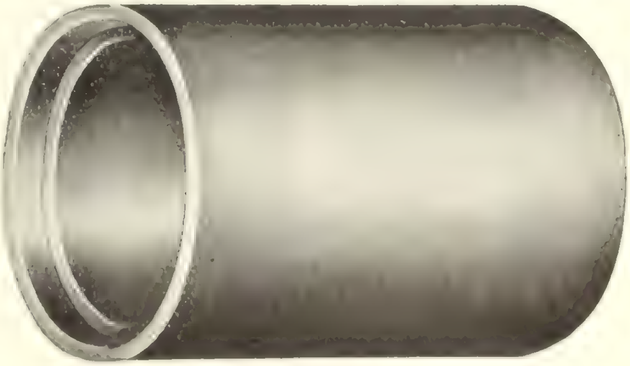

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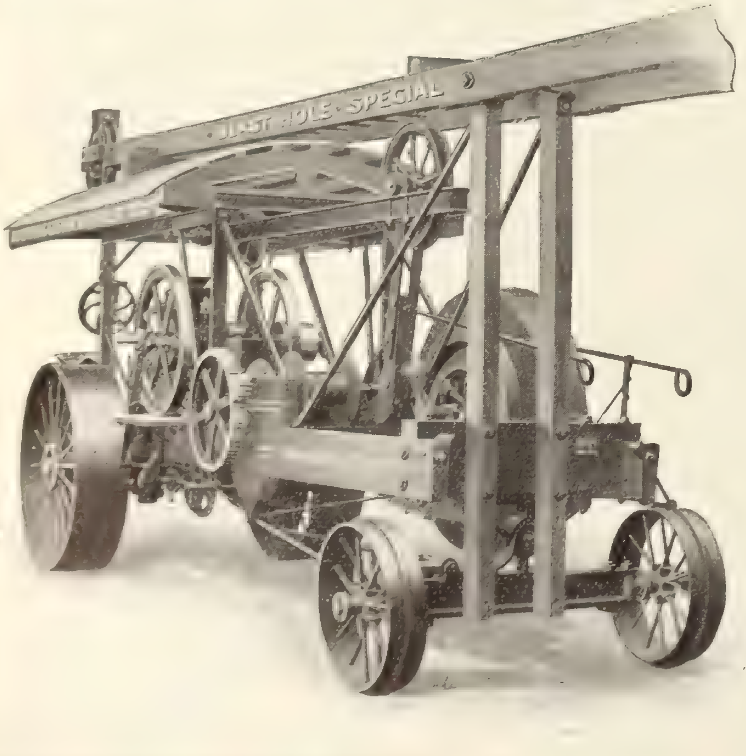

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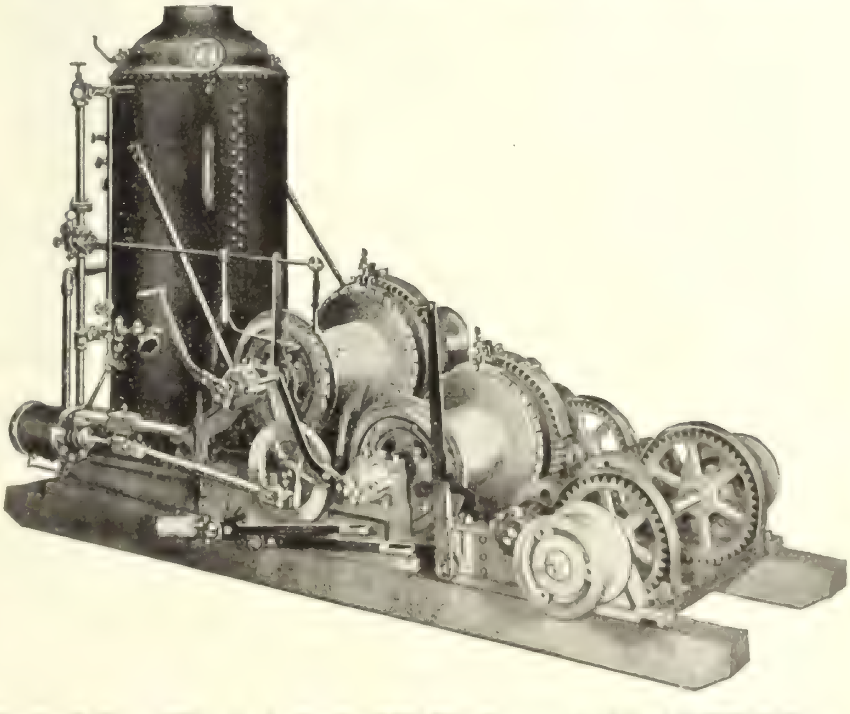

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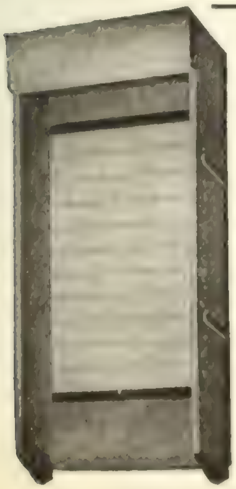

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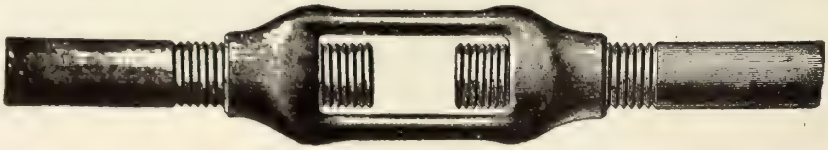

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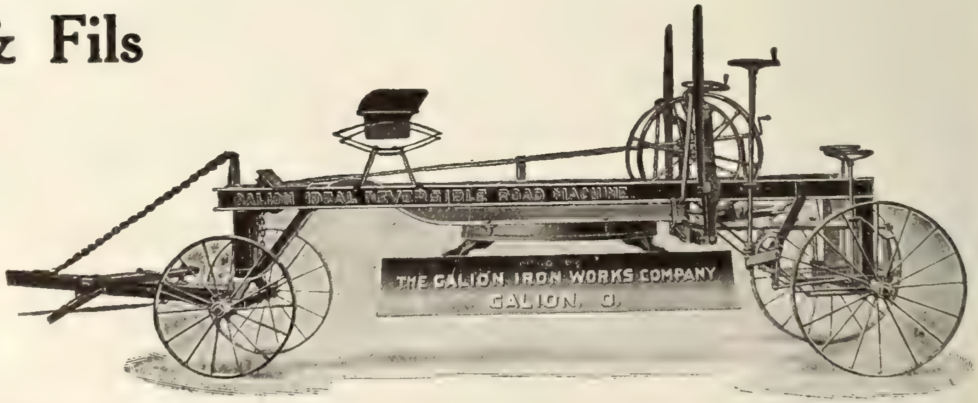
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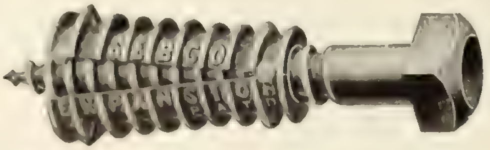

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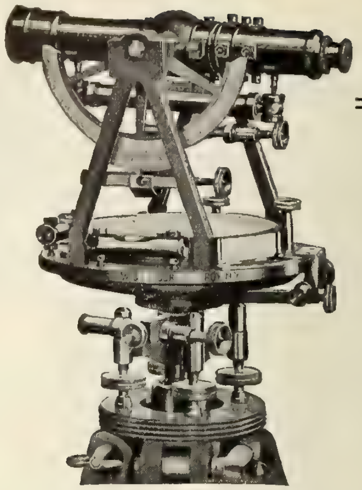

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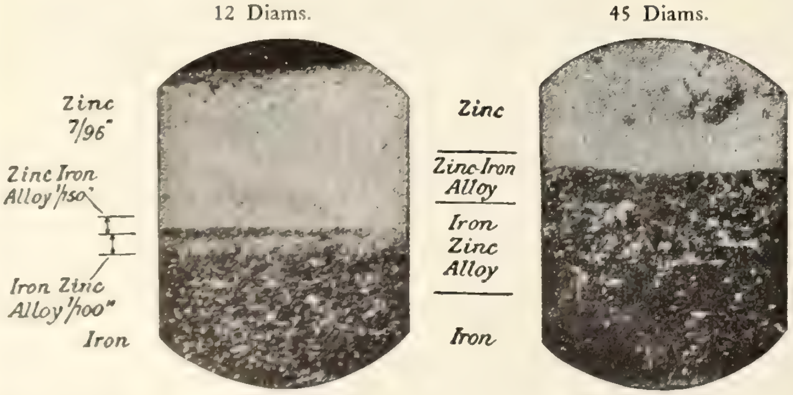

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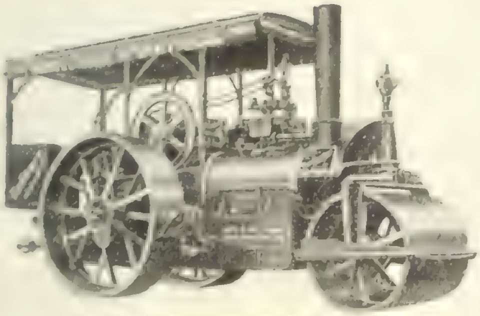

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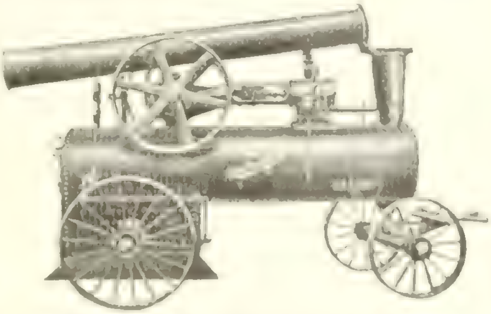

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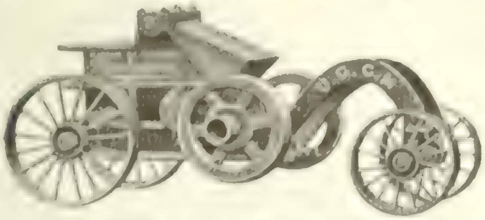

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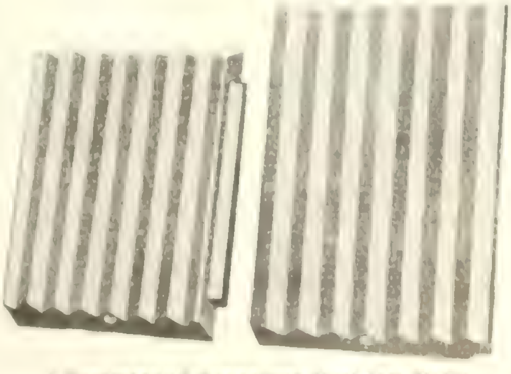

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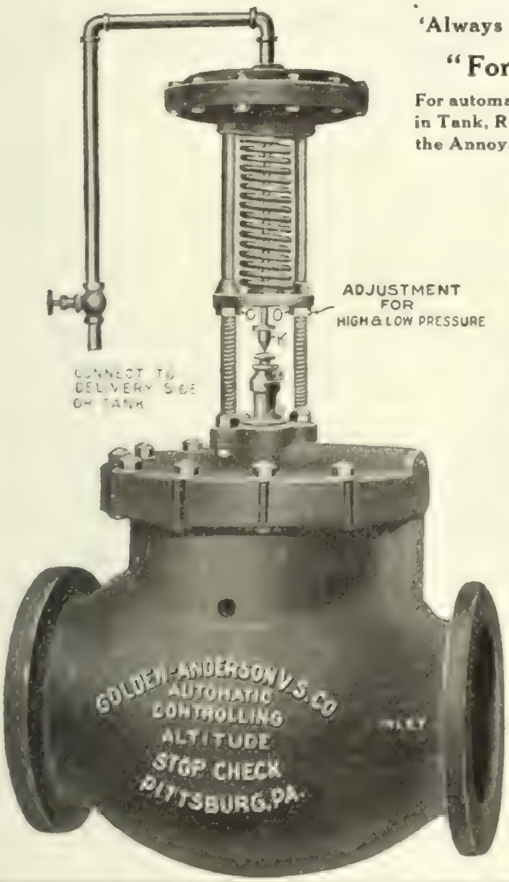

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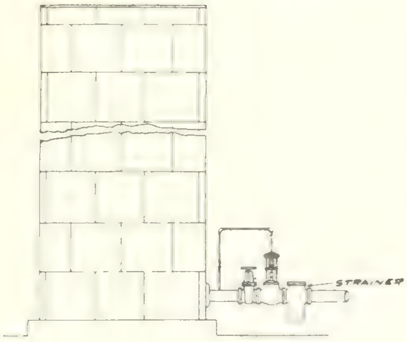

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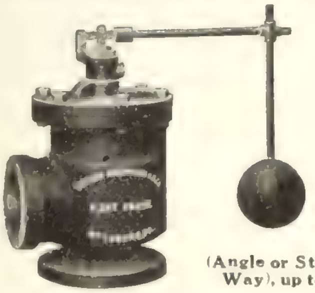

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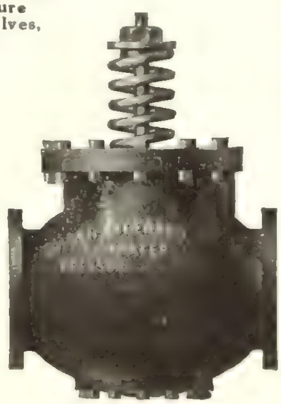

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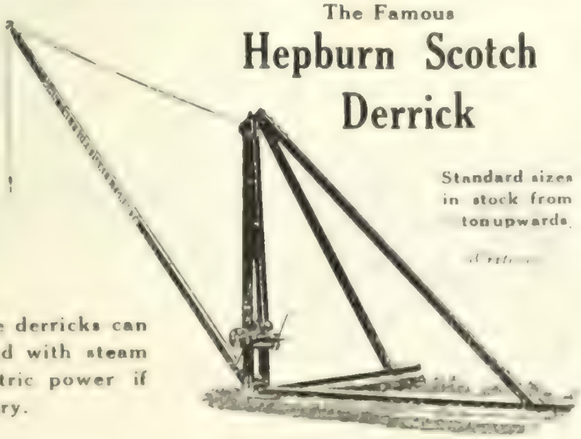

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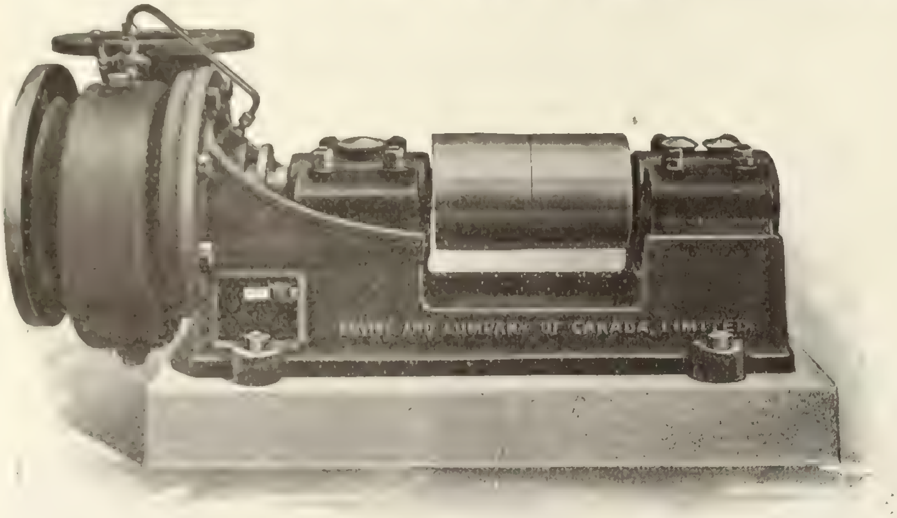

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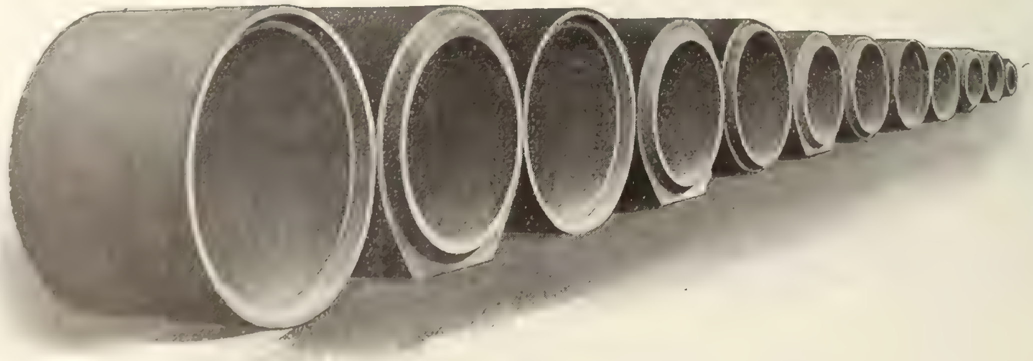

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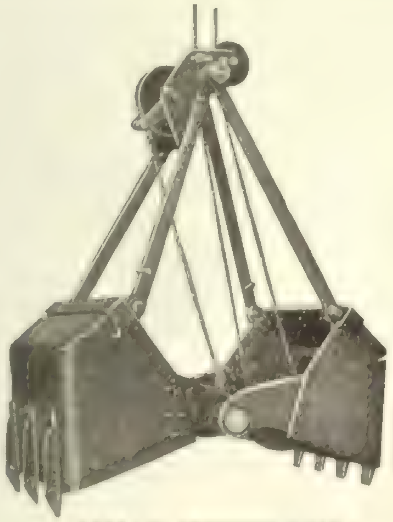

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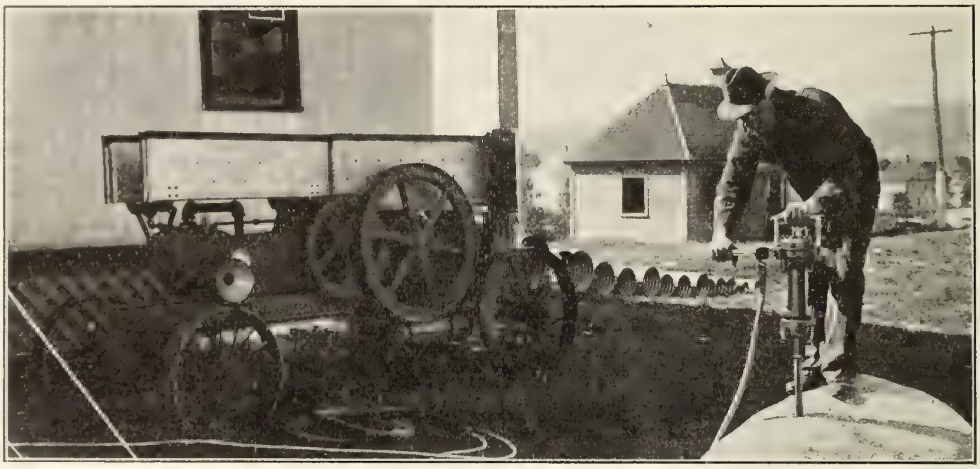

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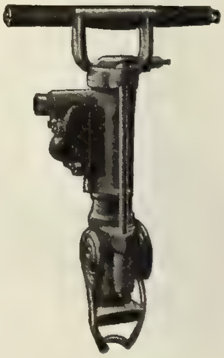

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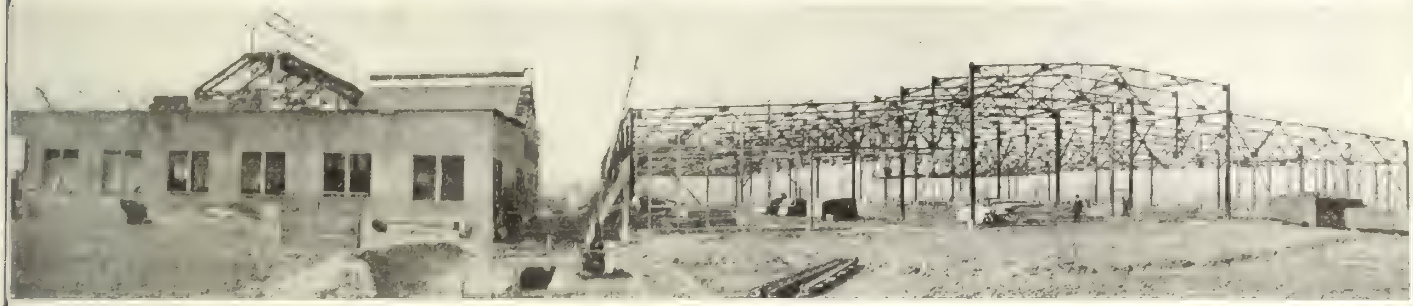

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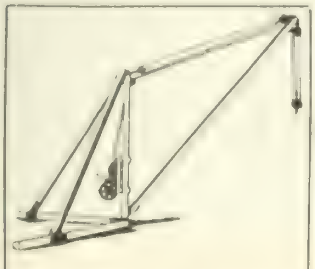

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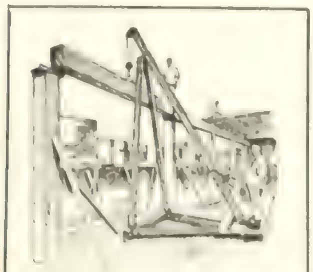
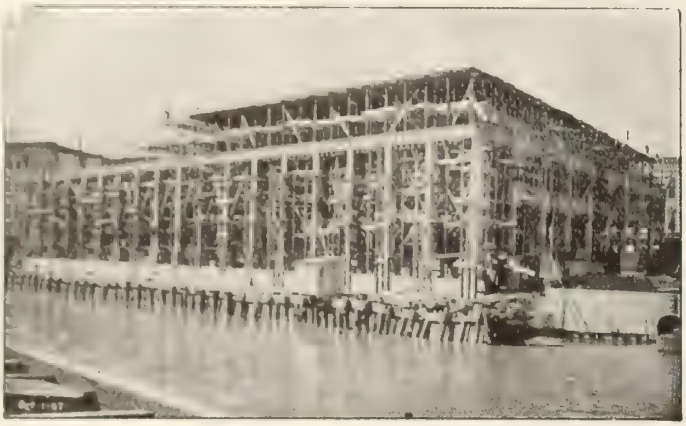


"A" FRAME BUILDERS' DERRICK 1500 lbs. capacity, [illegible] 2000 lbs. capacity [illegible]



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ESTABLISHED 1886

Contract Record and Engineering Review

Published Each Wednesday By
HUGH C. MacLEAN, LIMITED
HUGH C. MacLEAN, Winnipeg, President.
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HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

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LONDON, ENG. - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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"The Artistic Possibilities of Bonds and Mortars in Brickwork," the first part of which is published in this issue, is an essay on design in patterns for brickwork, with special reference to bond and the use of mortar. The various bonds in use are classified and illustrated by diagrams and the methods of using bond units in pattern are described and illustrated. The essay describes the structural uses of mortar, the artistic effects which can be produced, the various kinds of mortar joints, and the methods of using colored mortar. The concluding portion, Part II, will be published in our next issue.

Professional Bids

We have received a copy of a circular letter which has been sent by the Council of the Institution of Civil Engineers of England to the members of that body. "The Council," runs the circular, "have had their attention drawn for some time past to a practice which exists among Local Authorities, of inviting by advertisement engineers to submit in competition with others their terms for preparing plans and proposals for certain engineering schemes, accompanied then or at a later stage by estimates of the cost of the works proposed. In the opinion of the Council such a proceeding is very undesirable in the best interests of the Public Authorities themselves and is derogatory to the engineering profession. The Council desire to express emphatically the repugnance with which they regard the practice in question. They have every confidence that the members of the Institution will support them by declining to respond in any way to such advertisements as those alluded to."

We seem to have heard of protests of a similar nature having been made by contractors against the system of competitive tendering. Contractors have "to submit in competition with others their terms . . . . . for certain engineering schemes," and such terms have to be "accompanied. . . . . . by estimates of the cost of the work prepared." There is no recompense for the labour involved, no surety that work will follow even in regard to one among the number estimating; and when the hardship entailed has been put before the engineering profession no hand of sympathy has been extended. Contractors are expected to regard as a favour the permission to prepare rough plans, to take out quantities, to pay for the services of a staff of practical estimators, to undertake lengthy journeys, and to run an enquiry bureau. But when the engineer is asked to occupy the position which has been forced upon the contractor indignation is loudly voiced and "repugnance expressed."

That the practice referred to by the Council of the Institution of Civil Engineers is a reprehensible one admits of no doubt. Competition may be carried beyond the limits of endurance, and local authorities are certainly not justified in inviting tenders for professional services. There are recognised scales of fees and commissions in every profession, and these should be paid (by public bodies above all) to the uttermost farthing. It is unfortunate that engineers should be thus hoist by their own petard, and our sympathy would be keener had engineers ever exhibited the least sympathy with the unfortunate contractor. We fear much (and we regret to have to say it) that the repugnance expressed by the Council needs somewhat in the way of qualification. It is the old, old question of the top dogs over again. So long as the element of competition is excluded, the big jobs go to the big men. The small man, no matter what his attainments, stands no chance at all. He is clean out of the running. But directly tenders are invited, he will be very much in the running, for it will pay him to cut the price even below cost. The first rung of the ladder is the most difficult to negotiate; the other rungs may be mounted with almost mechanical precision. Judging by what does happen, the confidence of the Council in the fact that "members of the Institution will support them by declining to respond in any way to such advertisements as those alluded to" is singularly misplaced. The younger members, the members who are awaiting their first call, who are preparing for the first run, are more than ready to tumble over each other in their eagerness for the butter which will assist the swallowing of the dry bread of life. It is regrettable, but life is made up of hard and distasteful facts, and the members of the Council of the Institution—whose bread is buttered on both sides and on every edge—must be prepared to face at least one of them. May that fellow feeling which is said to make one wondrous kind lead the engineering profession (or at least its shining lights) to deal more mercifully with the humble but necessary contractor.

Engineering Topics in the Old Land

Concerning Criticism—Tampering with Tenders Once Received—A Side-Light on Architects' Estimates — Recognition of Professional Status

By the London, Eng. Correspondent of the Contract Record

THE Contract Record is so full, week by week, of "meat"—and by meat is meant good, strong satisfying pabulum of the mental kind—that the temptation to criticise (or at least to comment upon) what is presented becomes almost irresistible. There are papers and enough published which offer no inducement whatsoever of that kind. They have neither initiation nor originality; their editorials are colourless and non-committal; and if they have any opinions on anything they must hand them over to the sacred custody of the advertisement manager, for the readers hear nothing of them. A good editorial must provoke both comment and criticism, and its value may be pretty accurately gauged from its success in provocation, although it must be remembered that criticism does not necessarily imply either censure or unfavourable judgment. "Critic" is one of those words that is unfortunately losing its original meaning, and any caviller and fault-finder now arrogates it to himself. The writer would therefore prefer his "criticism" of certain articles which have appeared in the Record to be regarded merely in the light of a commentary.

"Unsavoury Contract Procedure"

In an article under this heading the action of the Bermondsey Borough Council, in allowing the amount of a tender to be altered after consideration of the whole of the tenders received, was condemned. As was rightly said, "it is an outrage upon those who play the game in good faith to allow any addition or subtraction once the hands have been shown." Fortunately, the instance is an isolated one, and in the usual course of things the next lowest tender would have been considered for acceptance. The expression "once the hands have been shown" is an exceptionally happy one in this connection, for competitive tendering partakes largely of the nature of a gamble. In a game such as "banker" the highest card turned up takes the bank; in the game of "tender" the lowest stands to receive the cheques (during the progress of the works); and neither game would be any longer possible were the players allowed to plead that they had, through inadvertence, shown the wrong card. The hands once proclaimed, there can be no question of a revoke. In certain games a player is permitted to "brag" or "bluff" as he pleases, but again, his hand once shown, he must abide by the count. The unfortunate fact in the game of tendering is that the players are not always present to lay their cards on the table. Contractors should be given the opportunity to attend, either personally or by deputy, and as the tenders are opened the amounts should be read out for their benefit. With the seals unbroken until the formal opening, no suspicion of unfair treatment could enter. Such an arrangement would be satisfactory to all parties concerned, and it should be clearly understood as a preliminary that the lowest tender (or preferably the lowest but one) would be accepted; subject to confirmation by the tenderer and the carrying out of the usual formalities. No alteration in an amount should be made on any pretext whatsoever, the "hands once shown."

Architects' Estimates

That architects' estimates are invariably low is indisputable, and the most potent factor in bringing about such an undesirable state of things is the ignorance of the architect. There was a time when architects actually superintended the building of the structures they designed, when they did not disdain to act as clerk of works. Sir Christopher Wren "clerked" the erection of St. Paul's Cathedral, and there is no record of his having dispatched a youth at more or less irregular intervals "just to see how things were going on." The curriculum of an architect's education includes building construction, but it does not include building, and no man should be regarded as an architect unless he has been in actual contact with building operations. The mere ordering of materials is an education in itself, and not five per cent. of those practising as architects could perform such a duty on a job of any size; and when it comes to structural supervision and the directing of mechanics not one in a thousand could emerge with credit from the ordeal. Plans are prepared and specifications written without regard for either the one or the other of these matters, and money is thrown away wholesale on scantlings that cut to waste, on special mouldings that are frequently quite inferior to those to be obtained from stock, on materials that have to be fetched from far afield when they could be supplied locally equally as well, on "purpose made" goods, and on a hundred and one other crank requirements and petty exactions. In the preliminary estimate of the cost of the projected work, these items are not considered, primarily for the reason that only a sketch plan or two has been prepared and not a word of the specification committed to paper. The client is quoted quite a fallacious figure and on this he gives the order to go ahead. As the plans and documents grow, the architect begins to realize that he has cut it "just a bit fine," and he sets about preparing his client for the shock, trusting however to luck (in the way of a low tender or two) to scrape through. But the day of reckoning arrives, and it is found that the building will cost from 20 to 30 per cent. more than the amount of the preliminary estimate, and the lowest man is taken into a kind of consultation and all manner of little economies are introduced and not a few glowing inducements held out to him if he will meet the architect in a small matter or two. Frequently, however, the plans have to be rigorously cut down and fresh estimates obtained, a course which inflicts great hardship upon the competing firms. There are, of course, many other reasons why architects' estimates are low, but they have been already dealt with in the editorial of April 1, in which issue also appeared an excellent article by Mr. Allen Hazen on the same matter.

Professional Status

It is refreshing to read that "the British Columbia members of the Canadian Society of Civil Engineers have recently shown considerable activity in endeavouring to get the status of the Engineer recognized by the Provincial Government," but the question that comes naturally to one's mind is: Why the British Columbia members only: why not the members of the whole society? And—had it not been for recent events in Ulster—one might have asked, why only one Provincial Government: why not all the Provincial Governments in the Dominion? As things are, the Englishman can no longer throw stones! Due professional status granted to engineers by the Government of British Columbia, the wedge will have been inserted for a similar concession in other Provinces; but surely the hands of the petitioners would have been strengthened if the whole forces of the Canadian Society of Civil Engineers had been concentrated in the attack.

Now, as to the definition of an engineer. That asked for in the new Water Act, that "Engineer means an Engineer of the Water District, who shall be a Civil Engineer who is a member of the Canadian Society of Civil Engineers, or a member of the Institution of Civil Engineers of Great Britain or of Ireland, or a member of a Civil Engineering society of equal rank in the British Empire or any foreign country," is good as far as it goes, and is perhaps the best that could be devised, but the saving clause added at the request of the Minister of Lands "gives the whole show away." This clause runs as follows: "But the foregoing definition shall not limit the power of the Lieutenant-Governor-in-Council or the Minister to appoint to any position created under this Act, any person who is in his opinion competent to fill such position," and the very thing that the deputation pointed out as objectionable in the Ditches and Water Courses Act, 1907, viz., that there was "nothing to prevent a Municipal Council from appointing a gardener, blacksmith or carpenter to carry out the duties of the Act as Engineer" applies in the new Act with perhaps equal force. It may, of course, be argued that "the Lieutenant-Governor-in-Council or the Minister" would never be guilty of making such ridiculous appointments, but nepotism and the influence brought to bear by members of the opposite sex may result in appointments equally inimical to the interests of the engineering profession. A carpenter would make a much better engineer possibly than an English college-bred youth whose knowledge of things in general was derived largely from the Latin and Greek authors, while even a blacksmith would know something about ironwork (chimney bars for example) and a gardener might prepare an excellent town plan on garden city lines. "Any person" is capable of wide interpretation, and the opinion of a Lieutenant-Governor-in-Council or a Minister (it may be submitted with all due respect) does not necessarily mean much. Still, the Western members are "to be congratulated upon the success of their efforts," and they certainly deserve well of their fellows. May the good work spread, until not only the engineers of the whole Dominion but of the Mother Country as well obtain Government recognition of professional status.

The Weston, Ont., Sewerage System

THE new sewerage and sewage disposal works at Weston, Ont., were officially opened on the morning of May 9. The sewerage work was constructed under contract by Messrs. Campbell, Lattimore & McAllister, of Toronto, while Mr. F. F. Fry was the contractor for the purification plant. The engineers for the work were Messrs. Aird Murray & Lowes, Toronto. The cost of installing the domestic and surface water sewerage was $111,511, and of putting in sewage purification works, $23,134, a total of $134,645.

The surface water from roadways is conveyed by sewers apart from the domestic flow direct to the River Humber, while the domestic sewage is conveyed by a separate system to a location situated on the banks of the river, where it undergoes a series of treatment processes, which produce an odorless, clear effluent.

The sewers are so constructed and laid out with reference to line and gradient, that perfect control is established by which any section of the system can be examined, cleaned, or any chokage removed without in the future disturbing the road surfaces. Manholes at all changes of grade and direction allow an inspector to look through any section of sewer, and if necessary clean out any section with sewer-cleansing rods. For the small sizes vitrified pipes with cement joints are used and for the large sizes, reinforced concrete pipes made on the trench side have proved very efficient and economical.

The purification works consist of three distinct processes, viz:—The arresting of the solids contained in the sewage; the oxidation of the sewage liquid by passing it through percolating filters; final treatment of the liquid from the filters by humus arresting tanks and subsoil irrigation on land.

The solids are separated from the sewage by aid of gravity in tanks, the arrested sludge gravitating to separate decomposing tanks where it is stored for a sufficient period to allow of thorough rotting. The rotted sludge which is odorless is conveyed to an open sludge drying bed, where it readily becomes firm enough to be handled and used as a manure.

The oxidation of the liquid sewage takes place in two filter beds, where the method of distribution and oxidation is automatic and extremely efficient, the liquid sewage being sprayed over the whole surface of the bed in even quantities.

An instance of the enterprising development of Western Canada by the railroads is provided in the announcement that seven hundred miles of standard gauge lines will be built in the province of Alberta this year, as compared with six hundred miles in 1913. More than $11,000,000 is available for construction work in Alberta on railroads guaranteed by the government. This sum includes $6,500,000 which has been deposited to the credit of the Alberta & Great Waterways Railroad agreement. This line will extend from Edmonton to Fort McMurray, 350 miles. The construction to be undertaken this year will include the Peace River branch of the Canadian Northern

Practical Considerations in Concrete Arch Design

Specially contributed by E. G. Kaufmann*

THE last few years have brought with them a very marked development in the form of masonry arch bridges. Our knowledge of theory and its practical application has made such strides, in so short a time, that in order to be able to make good, up-to-date designs it is necessary for the engineer to remain thoroughly abreast of the times.

The idea of stone bridges is ancient. The Romans used them extensively, but they seldom exceeded spans of eighty feet. A bridge built of stone is a monumental structure, combining beauty with durability. London Bridge, built of granite, is an example of the most stable and lasting structures.

Concrete bridges, however, are modern. Comparatively few were built more than thirty years ago. Although concrete, as it is used at present, is not as durable as good stone, its wearing qualities are such as to create what may well be termed "a permanent structure." In appearance it falls well into line with modern architectural principles, while its cost is far less than that of stone.

The development of the use of reinforced concrete naturally suggested its application to arch design. The economy of reinforced over plain concrete for arches is not very marked, for the stresses in an arch are chiefly compressive, and concrete is better adapted to take such stress than steel. The introduction of steel to take compression is not an economy. However, the introduction of steel makes it possible for tension to exist in parts of the arch ring, thus making it permissible for the thrust line to depart from the middle third. Morover, reinforced concrete is a more reliable material and is better suited to resist certain unforeseen or uncertain stresses—such, for example, as are due to temperature and construction distortions.

The hingeless, or fixed arch, with which this paper will deal chiefly, is the oldest form in use. The common forms of this type are the Melan and the Monier, while there are many modifications of these. The Monier arch employs mesh reinforcement close to the extrados and intrados. In the Melan arch heavy structural ribs are put into place and filled in with concrete. The main advantage of this form is that the steel ribs are capable of supporting the entire ring before the concrete has set. In this country most of the designs employ rod reinforcement in almost any form.

Hinges are applicable in arches built of almost any material. The advantage is that, as the thrust line must pass through the hinges, the arch becomes determinate and presents a more reliable and simple design; moreover, a hinged arch is less liable to failure due to settling of the abutments, and the large excentricities of the temperature thrust are avoided.

It is frequently asserted that hinged arches are more economical than fixed arches. This is questionable, as the cost of the hinges is very considerable, and because whatever small saving there is in concrete cannot properly be allowed for at much above the cost of the materials, the cost of forms being approximately the same for the two types. The appearance of the hinged arch is, in the writer's opinion, in its disfavor. To the trained eye, at least, the increase in depth at the abutments of the fixed arch is pleasing, as this is the point of maximum shear. In the three-hinged arch, on the other hand, the ring is smallest at the crown and abutments, as there it receives thrust only. The moment is maximum at the quarter points, and the bulge which must exist to resist this is unsightly.

Hinges, usually of stone, are frequently placed in the crown of fixed arches during construction, being grouted in after the entire arch ring has set. This is a very good safeguard against cracks due to construction deformations, particularly in arches of long span.

The most modern arch of either type is built of ribbed rings instead of building the arch ring of the entire width of the bridge. This produces a lighter construction and is more economical. Ribbed rings, of course, necessitate open spandrels.

Before deciding upon the kind of arch to be used it is important to study existing conditions. The item of cost will have considerable weight in this connection, and it will usually pay to prepare several preliminary estimates. Local conditions play an important part, and frequently the cheapest bridge will not be the most economical.

If rock foundations are available, the engineer is free to choose. In this case the writer would recommend the fixed type, on the grounds of economy, appearance, and as it is less liable to vibrations. In very flat arches, however, the eccentricity of the crown thrust due to temperature may be so great as to make it advisable to introduce a hinge.

If, on the other hand, the bridge must be founded upon earth, the problem becomes less reliable. One of the fundamental assumptions of all theory is that the abutments are immovable, and any settling may produce stresses which cannot even be guessed at. It is true that stresses due to abutment displacements can be computed if those displacements are known, but this is usually limited to construction and elastic distortions. Settling of foundations is entirely unknown and accidental. To make the structure strong enough to resist stresses due to this cause would greatly increase the cost, whereas some other device would produce superior results more economically. On poor soil, where settlement is probable, a concrete arch should not be attempted unless it is considered that piles would furnish ample rigidity. In case it is necessary to found an arch of long span and low rise upon earth, even though reasonably good, a three-hinged arch would undoubtedly be safer, as it can lend itself to slight motions. If a hinged arch is to be used it will be better in the majority of cases, to use ribbed rings. It is always advisable for each hinge to be continuous, and hinges of the length required for a barrel arch are not only costly but difficult to handle. In this connection it should be remembered that the ribs should be well braced together.

The form of the spandrels is also to be decided upon. For railway bridges, filled spandrels are usually in favor. A barrel arch with the fill carried across it adds to the uniformity of construction, besides being easier to build and sometimes cheaper than an open spandrel bridge. Moreover, the solid walls and filling are likely to produce an independent arch action which will assist in supporting them. It is probable that many arches of inadequate design owe their stability to this cause. Furthermore, the filling tends to distribute the loads and absorb shock. For these reasons it will often be of advantage to build short railway bridges with solid filling. However, the arch action of the filling cannot be relied upon, failing altogether in long spans and merely adding its weight to the load on the bridge.

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Another assumption of all theory is that the arch ring is free to act as an elastic body. It is evident that filled spandrels seriously curtail this freedom of action. In fact, this hindrance is so marked, that any refinement in the design is nullified, and the stresses computed may differ greatly from those actually existing. For a long or flat arch, therefore, filled spandrels should not be considered. The floor system should be provided with expansion joints in order to prevent unnecessary strains in the ring.

A thoroughly scientific analysis should not be neglected. The design of a concrete arch is one of the most delicate operations which an engineer is called upon to perform. Small differences in the shape or form of the arch produce very great differences in its strength. Surely it cannot be an economy to slight the design of a monumental structure, which is intended to stand for ages, in order to save a few hours, or days, of the engineer's time. The practice of using empirical formulae, and constructing an arch which "looks like" another that has stood, cannot be too strongly condemned. When this is done because of the engineer's lack of knowledge or familiarity with theory, it would appear that strict government control were needed. At first glance the process may appear formidable, but really it is not so. When familiar with the details the design becomes simple, though of course somewhat laborious. An analysis can easily be carried through in one day, or at most two days.

In the design of an arch, after the type, loading, floor system and other details have been decided upon, the first consideration should be the shape of the ring. The importance of a good shape, in economic design, cannot be overestimated.

In this connection it will be well to point out some of the requirements of good design. The stresses in an arch are inherently compressive. Although tension may exist, it is far better to reserve it for temperature and unforeseen effects. The ratio of moduli of elasticity of steel to concrete is commonly assumed to be 15. Now steel costs considerably more than fifteen times its volume of concrete; hence it is more economical to make the thickness of the ring adequate to keep the chief stresses compressive than to permit tension and introduce a great deal of steel. Frequently the ring is so designed that the dead and live load stresses are all compressive, and enough steel is used to take care of the tension caused by temperature. As long as the thrust line remain in the middle third of the ring, no tension will exist. In view of this fact the thrust line should be kept as close to the centre line of the ring as possible. With uniform or stationary loading these two lines can easily be made to coincide fairly closely. There are two ways to do this: one is to fit the thrust line to the centre line by means of a judicious distribution of the dead load. Whenever the shape of the intrados is fixed by architectural or other reasons it will be of advantage to proceed in such manner.

In general, it is better to fit the centre line to the line of thrust as determined by trial. The following will serve as a guide and lessen the labor of approximation.

In Fig. 1 consider the parabolic arch [illegible] in which the horizontal projections of the divisions are equal. The line M-N is vertical, and P is any pole. Successive rays are drawn from P to 0′, 1′, 2′, etc., parallel respectively to the tangents at points 0, 1, 2, etc., of the arch. It can be seen that the intercepts on the force line M-N are all equal. In other words, if the total load on the bridge is uniform from end to end, the thrust line will be parabolic. This can never occur, because the weight of the ring and spandrels is always greater at the springing than at the crown

Proceeding in the same way with a semi-circular arch, it can be shown that the load nearest the springing must be infinitely great, which is of course impossible. As the arch becomes flatter the parabola approaches the circle, but the thrust line can never exactly coincide with either one. It will generally lie about half way between the two. The radius of the circle passing through the springing and crown points can be found from:

$$R = \frac{L^2}{8h} + \frac{h}{2}$$

where L = span of intrados and h = rise of intrados. The parabola for the same points can be drawn by means of the following formulae for co-ordinates:

$$x = \left\{\frac{L}{2}\right\} n \qquad y = h\,(2n - n^2)$$

where L = span of intrados, h = rise of intrados, n = any fraction or decimal less than one, x and y are co-ordinates measured from the springing points as an origin. The circle and parabola having been drawn, as in Fig. 2, a three-centred curve can be drawn midway between them, as a trial intrados, for open spandrel arches. For filled spandrel arches, however, the intrados will be somewhat nearer to the circle. This process will give a fair approximation of the correct shape, but must be investigated, and revised if necessary. It can be checked by drawing the thrust line for dead or dead and half live load. For this purpose the live load must be reduced to an equivalent uniform load. The method is described below.

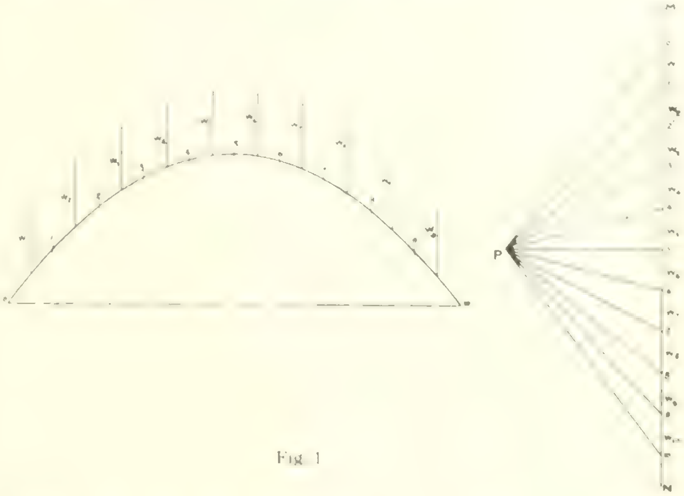


Fig 1

The dead load alone is frequently used for this purpose, but it is a little more accurate to use the load for average working conditions. Such conditions will evidently be obtained when half of the live load cover the bridge from end to end.

The thrust line for unsymmetric loading will, of course, depart from the centre line, but generally it will be as close as it is possible to make it.

When the shape of the arch has been found correct, and after an approximate determination of the stresses which makes possible an intelligent assumption for the thickness of the ring, the rigid analysis can be commenced.

The older method of applying the elastic theory by dividing the ring into sections of constant ds/I is probably the shortest when only one or two assumptions of loading are made. But the stresses by this process are neither maximum nor minimum in any section. The greatest stresses cannot be found by using either the whole or half length of the bridge loaded. They can be approximated, by this analysis, only after a great many trials, and as the entire analysis must be carried through for each trial, the labor is very great. By the use of influence lines the only preliminary approximations are the shape and thickness of the arch ring. Almost the entire analysis can be carried through before any loads are applied, and any desired loading can then be investigated with very little labor. The influence lines indicate the exact position of the live load necessary to produce maximum and minimum stresses.

David A. Molitor, in the last chapter of his "Kinetic Theory of Engineering Structures" (McGraw-Hill Book Company) gives a very lucid and satisfactory explanation of such an analysis by the method of virtual work. He carries through a complete sample analysis of a symmetric and an unsymmetric arch. By this method the resultant polygon need not be found, the stresses being found directly. However, as it entails very little extra work, it is well to construct a resultant polygon for unsymmetric loading, as it indicates conditions throughout the ring at a glance, and affords some valuable checks. This method appeals very strongly to the writer.

Another method which employs influence lines was explained by A. C. Janni in the Journal of the Western Society of Engineers—May, 1913. This is the method of the "Ellipse of Elasticity." Like the other, it admits of the investigation of any loading, but for highway bridges, where the live load is small compared to the dead load, and can be considered uniformly distributed, the preliminary analysis will suffice, saving the labor of the final investigation.

These two exact methods can be carried through with such ease and celerity that it does not seem worth while to employ approximate methods. The most prejudicial loadings are fully investigated, and consequently they can be regarded with full confidence, provided, of course, that the foundations be adequate and that the construction be carried on in a workmanlike manner.

The effect of temperature has frequently been omitted in arch design. The fact that such arches have not failed is no excuse for omitting it in designs. Their stability is probably largely due to the effect of the spandrel filling, as mentioned above. Ira O. Baker, in his "Masonry Construction," gives the results of some tests of the range of internal temperatures in concrete, which showed that while the temperature of the concrete did not closely follow the atmospheric changes, it still varied by about 45 deg. **Fahrenheit** during the year. Such a range of temperature would produce stresses, greatest in flat arches, which should not be neglected. A range of 25 deg. up and 25 deg. down will usually be sufficient. As the arch will not be built in the coldest weather, and as heat is generated in the concrete due to setting, a rise of temperature need not always be considered, although the work of doing so is small.

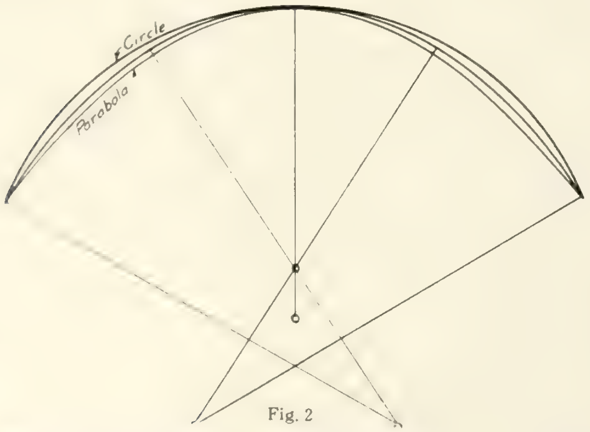
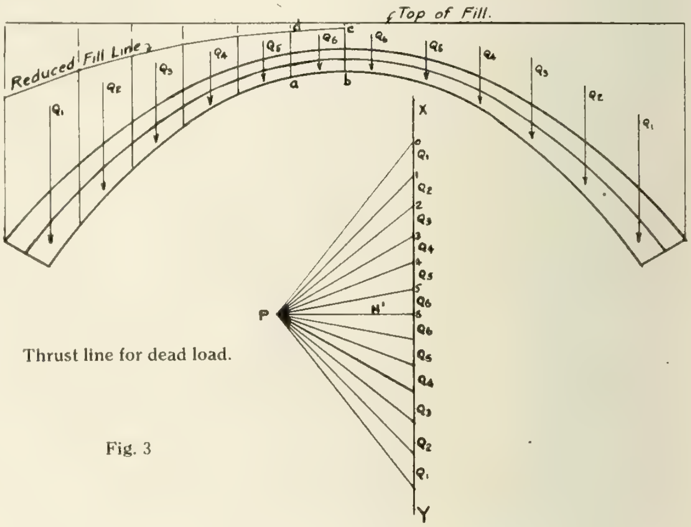


Fig. 2

The shrinkage of the concrete due to setting, and the shortening of the arch axis due to striking of falsework, produce stresses similar to those produced by a fall of temperature. These stresses can therefore be allowed for by assuming a greater fall of temperature.

Rib shortening due to axial thrust produces stresses opposite to those due to a fall of temperature. For arches of good rise they are small, and, being on the safe side, may be neglected. The time saved by neglecting any of these effects is so small that it is hardly worth while to omit any of them.

As was mentioned above, the actual stresses in a filled spandrel arch are so far from those found in any analysis that the time spent in such a design is, as a general rule, practically wasted; however, when the loads are heavy, the exact design should always be used, as it will give far closer results than any approximate method. For flat or long span arches filled spandrels should not be used if they can possibly be avoided; if they must be used an exact analysis is important.



Thrust line for dead load.

Fig. 3

The following approximate method is valuable for preliminary estimates. It may be used for highway bridges of small span and good rise, in the absence of any other, although it is always advisable to use a more rigid analysis if possible.

This design is based upon the assumption that the most favorable thrust line is the most probable one, and that if one thrust line can be drawn which does not depart from the middle third of the arch ring, then the true one will surely lie within the middle third. This assumption has never been proved infallible, but in all likelihood it is near the truth. Voussoir arches have frequently been designed upon this assumption, with success.

In making use of this principle, the thrust line for any case of loading should always remain within the middle third. The addition of temperature stresses will then introduce tension and enough steel must be added to fully resist it. ½ to 1 per cent. of steel should be added, at least, near both the intrados and extrados.

The shape of the intrados is first approximated, as described above. Then by the use of any empirical formula a trial crown thickness is found. The following formula, from Trautwine, will answer this purpose: $d = \frac{1}{4}\sqrt{R + L} + 0.2$ where d = depth of crown; R = radius of intrados at crown; and L = span of intrados, all in feet.

The extrados is then drawn, making the arch ring at the quarter points 1¼ to 1 1/3 times the depth at the crown, and at the springing 1½ to 2 times the crown depth. Draw the axis midway between the two, and divide into any number of parts, preferably equal, by vertical lines as shown in Fig. 3. A single rib one foot wide will be considered, so that the area of each section of the arch ring in square feet will be equal to its volume in cubic feet. Draw a curve which would represent the height of fill if it were solid concrete instead of earth, as shown by the "Reduced Fill Line" on

Fig. 3. The weight of dead load at any point is then the area of the section, between the intrados and the reduced fill line, multiplied by 150 lb. To illustrate, the dead load at Q_6 = (area a-b-c-d) x 150 lb., and acts through the centre of gravity of a-b-c-d. In this way all the dead loads are computed, and their lines of action drawn. The horizontal pressure of the earth may be neglected. These loads are laid off to scale on the force line X-Y. The horizontal thrust at the crown is computed from the following formula:

$H = \frac{Wx}{h^1}$, where H = crown thrust; W = sum of loads $Q_1 + Q_2 + \dots + Q_6$.

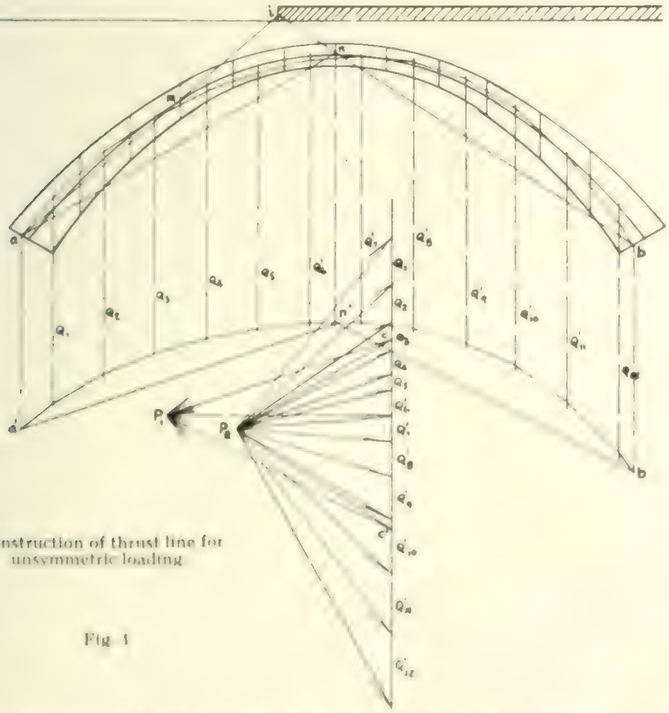
x = distance of centre of gravity of these loads from the springing;

and h^1 = rise of axis.

H is laid off horizontally, to the same scale, from the centre division of X-Y to determine the pole P.

The rays P-0, P-1, P-2, etc., are drawn. Now the thrust line can be drawn by commencing at the crown point of the axis, drawing a horizontal line to intersect Q_6. From this intersection another line, parallel to P-5, is drawn to intersect Q_5; from this point a line parallel to P-4 is drawn to intersect Q_4, and so on. This thrust line will pass through the axis at the springing. If it coincide closely with the axis, the shape of the intrados is accepted; if not, the shape must be revised and the operation repeated. The normal thrust on any section can be scaled off, being the component of the corresponding ray, parallel to the tangent to the axis at that point.

The thrust line for unsymmetric loading is now proceeded with. Referring to Fig. 4, the live load will cover that part of the span between the right end and the point "i." "i" is found as the intersection of a-m and b-n, where a and b are at the edges of the middle third; m is the quarter point of the axis; and n is ⅙d above the axis; all as shown. This position of the load will give nearly maximum stresses in the springing and quarter points. The loads Q_1 to Q_6 are dead loads. Compute Q'_6, Q'_7, Q'_8, etc., and lay them all off to scale on the force line, as shown. Assume the trial pole P_1 and draw the trial thrust line a'-n'-b', where a', n', and b' are vertically in line with a, n, and b. The thrust line is kept out of the drawing in this case in order to avoid confusion of lines. Draw a'-n', and P_1-c parallel to it, to find c. Then draw b'-n', and P_1-c' parallel to it to find c'. Now draw c-P_2 parallel to a-n, and c'-P_2 parallel to b-n, to find the true pole P_2. With the force line already drawn, and the pole P_2, construct the true thrust line, commencing at a; it will pass through n and b. If this line lie everywhere within the middle third of the ring but approach closely to the edge in two points, then the thickness of the arch is accepted, and the stresses are computed. If the thrust line pass outside of the middle third in two places, then the arch ring must be made deeper. However, if the thrust line pass out of the middle third in one point only and be far inside at every other point, then the point n should be moved a little up or down and the operation repeated.



Construction of thrust line for unsymmetric loading

Fig. 4

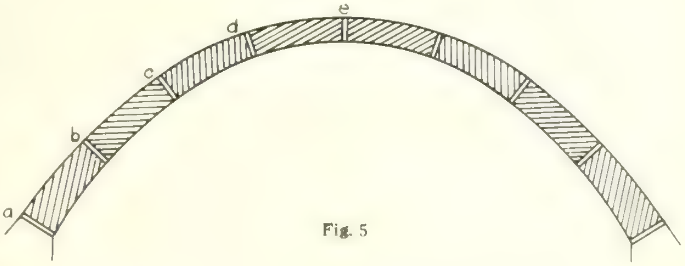


Fig. 5

If this thrust line be acceptable, then the normal thrust and its eccentricity for any section can be scaled. The stresses in any section can then be computed by means of Navier's formula:

(1) $f = \frac{N}{d}\left\{1 \pm \frac{6e}{d}\right\}$, where: f = stress in lbs. per sq. in.,
e = eccentricity in feet,
d = depth of section in feet,
N = normal thrust in lbs.

These stresses will all be either zero or negative, as no tension will exist.

In a similar manner the thrust line and stresses for a symmetric loading, in which the live load covers the middle of the bridge, from quarter point to quarter point, can be found. This will procure nearly maximum stresses in the crown section.

Mr. Molitor showed that the only critical points are the springing, the crown, and a point near the quarter point. In this approximate method it will be near enough to consider the springing, crown and quarter points, and only these need be computed.

To the stresses thus found should be added those due to a change of temperature. In the Proceedings of the American Society of Civil Engineers for January, 1914, page 147, Mr. L. J. Mensch has deduced the following approximate formulae for temperature stresses, which can be applied to arches of this character:

(2) Stress in crown section = ± 1,540 d/h.
(3) Stress in springing section = ± 1,256 d/h.
where: d = thickness of arch at crown;
and h = rise of arch.

These stresses are the same for any span and are figured for a variation of 50 deg.

At the quarter points the temperature stresses are nearly zero. The stresses found by means of equations (2) and (3) should be both added and subtracted from those found for the corresponding sections by means of equation (1). Whenever tension be produced by the application of the temperature stresses, it must be cared for by a sufficient amount of steel. If necessary the arch ring should be made thicker in order to reduce the live load stresses. Although this will increase the temperature stress, it will decrease the total stress.

The above method, with the exception of the temperature

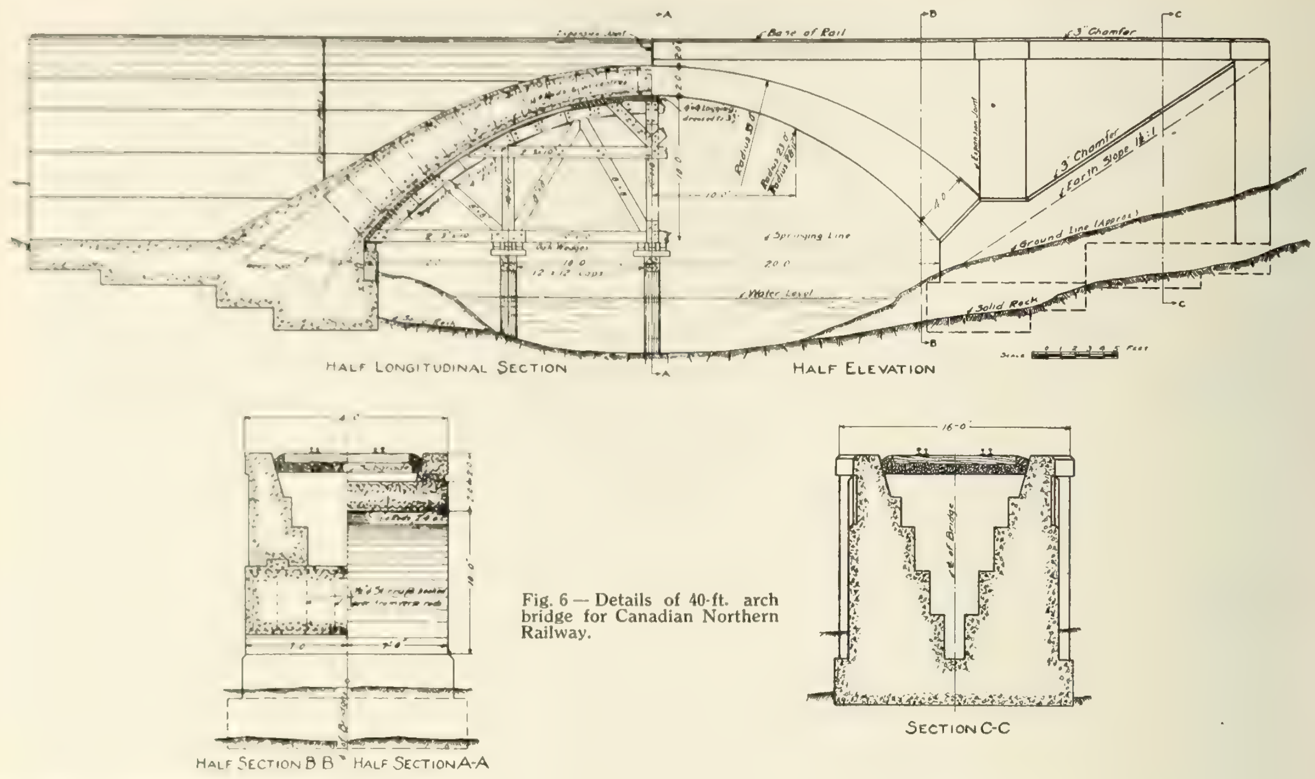


Fig. 6 — Details of 40-ft. arch bridge for Canadian Northern Railway.

allowance, is employed by Mr. Molitor as a preliminary investigation.

It must be borne in mind that an analysis by this method is merely an approximation and should never be used as a final analysis of an arch of low rise, long span, or heavy loading.

The reliability of all theory depends largely upon the stability of the abutments or piers. Many failures have resulted from the unscientific design of these important features. It should be remembered that the abutments must be designed not only to present sufficient bearing for the vertical pressure but also to horizontal thrust.

Much also depends upon the methods of construction. The centering must be made firm enough that it will not settle when the concrete is placed upon it, in order that the arch may have the shape it was designed for and that the concrete will not crack before it has firmly set. The centering is sure to settle to some extent, and consequently the manner of placing the concrete should be given ample attention.

If the arch be small enough that the entire ring can be poured in a single day, this difficulty is easily overcome, for then the entire dead load is applied to the centering, and the arch keyed, before the concrete has fully set.

If, however, the placing of the concrete be begun at the abutments and be carried toward the crown on successive days, then each day's work will produce a greater degree of deflection in the centres, thus introducing serious construction stresses into the concrete at the springing, which has already set. This effect can be largely overcome by pouring the concrete in voussiors, leaving spaces as at a, b, c, etc., in Fig. 5. Then these intervening spaces are all keyed at the same time.

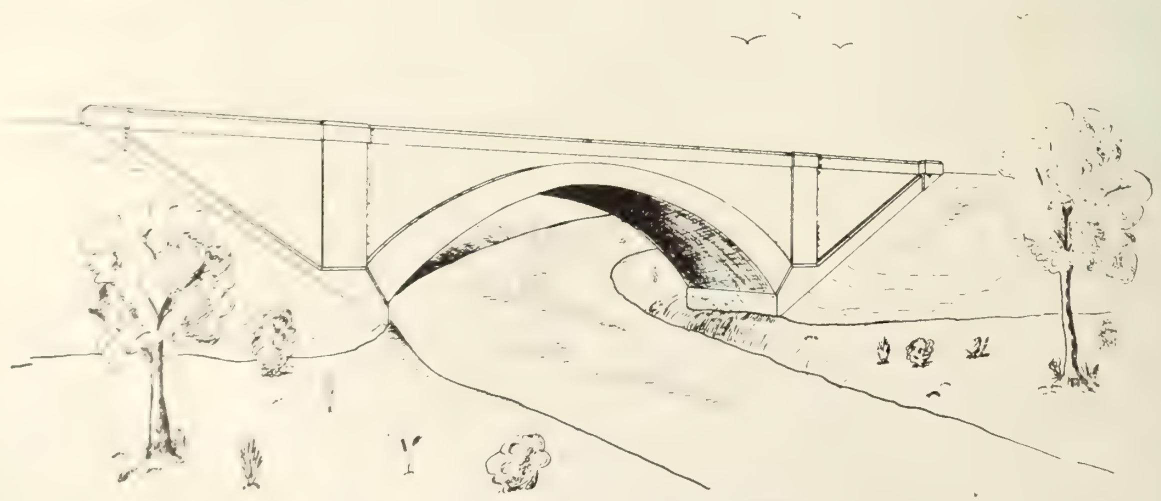


Fig. 7.—40-ft. arch bridge for Canadian Northern Railway.

Figs. 6 and 7 show the details of a 40-foot arch bridge designed for use on the Canadian Northern Railway. The method of virtual work was employed. The stresses due to dead and live load were all compressive. A rise and fall of 50 deg. of temperature were considered, thus including an allowance for construction deformations. This introduced tensile stress, which was provided for by the introduction of steel reinforcement. The bridge was designed for Class Heavy, Dominion Government Specifications.

The writer considers the simplicity and appearance of strength, as shown by this bridge, to be the most effective methods of producing an aesthetic structure

Canadian Constructional Centres

A Compendium of Engineering and General Progress Data Relating to the Activities of the Principal Towns and Cities of the Dominion. Arranged Alphabetically by Provinces.

Newfoundland, Nova Scotia, P.E.I , New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia

PART II.

IN this issue we publish Part II. of the Alphabetical Reference to the towns and cities of the Dominion inaugurated in our Annual Number (May 13).

In the interests of any new readers it may be well to say that this feature comprises statements relating to the engineering and general activities of the constructional centres of the Dominion. The particulars given include, as far as possible, comparative population and asessment figures, comparative returns of building and engineering work, and details as to roadways, water supply, sewerage, and garbage disposal. The articles are published alphabetically by provinces in the order given under the main heading on this page. Part I, which appeared in our last issue, comprised statements regarding the towns and cities of Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick, and Quebec, and the cities (only) of Ontario. The data available from Ontario was so voluminous that it was considered advisable to deal with the cities and towns separately. In Part II, in this issue, we give the towns of Ontario and the cities and towns of Manitoba and Saskatchewan. The feature will close next week with Part III, which will be devoted to the Alberta and British Columbia returns.

Ontario (Towns)

Barrie, Ont.

This town was incorporated in 1853. The population has dwindled from 6,800 five years ago to 6,555 in 1913, owing chiefly to the transfer of railway employees to another centre. The present assessment is three and one-quarter million dollars, which is slightly in advance of the assessment of five years ago. The tax rate last year was [illegible] mills. In 1909, $50,000 was expended in building, whereas the total in 1913 reached [illegible]. Engineering work in the same periods total respectively $21,500 and $40,000. The town has [illegible] miles of roadways, of which [illegible] are [illegible], 1 concrete, 1 broken stone and the remainder earth. The estimated expenditure on road work this year is [illegible]. The sewerage system is part separate and part combined and the method of disposal is by sedimentation tanks. An extension of 6,500 ft., at a cost of $10,000, and two additional sedimentation tanks, to involve an outlay of $25,000, are contemplated. Garbage is collected weekly and disposed of privately. The water supply is from artesian wells, of which there are three, from 100 ft. to [illegible] ft. in depth.

Bracebridge, Ont.

This town was incorporated in [illegible] and has a population of 3,000, with an assessment amounting to $860,000 and a tax rate last year of [illegible] mills. Building amounting in value to $15,000 is the estimated expenditure contemplated for the present season. The town has thirteen miles of macadam roadways. The garbage is burned at a dump. The water is from artesian wells pumped direct to the mains from a reservoir. It is the intention to install a new pump at a cost of $3,000 in the near future.

Brampton, Ont.

This town has a population of 3,800—an increase of 700 on the returns for 1909. The present assessment is $2,000,000 as compared with 1¼ millions in 1909. The 1914 tax rate is 23 mills. In 1909 the expenditure on building was $35,000 and the 1914 estimate is $200,000, the corresponding figures for municipal engineering work being $12,000 and $35,000. There are 3½ miles of roadways, comprising asphalt block, 6,500 sq. yds.; vitrified brick, 1,800 sq. yds.; dolorway, 7,000 sq. yds.; concrete, 9,000 sq. yds., and macadam, 100,000 sq. yds. The expenditure on road work this season is placed at $10,000. The sewerage is the separate system, no storm water being allowed. The method of disposal is by septic tank, there being no filtration beds. The sewage empties from the tank directly to the River Etobicoke. Extensions to the sewerage system will be made this season at a cost of $10,000. These extensions are being planned to serve the southern portion of the town, and a new main is being installed direct to the septic tank. The garbage is collected privately once a week and burned. The water supply is from artesian wells, the water being raised by compressed air and pumped from a gathering basin to the mains, the overflow going to a 1,000,000-gallon concrete-lined reservoir, situated about three miles east of the town and connected to the distribution system by a 12-in. main.

Brockville, Ont.

This town was incorporated in 1832. Its population, which is 9,641, has remained practically constant during the last five years. Last year the assessment was $5,084,150, more than three-quarters of a million dollars in excess of that of five years ago. Last year's tax rate was 28 mills. The total value of building done in 1909 was $14,700, and $150,000 is the amount estimated for the present year. The corresponding figures for engineering work are $10,000 and $118,000 respectively. The municipality has twenty-six miles of roadways, classified thus—sheet asphalt, 1¼ miles; granite blocks, ⅛ mile; tarvia, ¼ mile; macadam, 15½ miles, the remaining 7 miles being graded. The road work for the present season is estimated to cost $27,500. The sewerage system as originally constructed was a 3-pipe system sanitary sewer, with agricultural tile laid along the side and storm sewers laid at a shallower depth. The sanitary sewers extended some years ago are still in existence. There is no disposal system in operation at present, the sewers discharg ing into the St. Lawrence River. Extensions to the sewerage system, estimated to cost $20,600, are divided almost equally between ordinary extensions and an intercepting sewer with pumping plant. The garbage is collected in ordinary carts and deposited on a dump. The water, which is drawn from the St. Lawrence River, is chlorinated at a pump well and pumped direct into the mains by steam power. The pumping plant consists of two Holly Gaskill horizontal pumps of 1,500,000 U. S. gals. daily capacity, and one pump (same type) of 4,000,000 U. S. gals. daily capacity. The extensions under construction consist of one 3,000,000 U. S. gal. motor-driven turbine pump, one 3,000,000 gal. capacity steam turbine-driven pump, etc., with a new power-house in addition, at an estimated cost of $47,000. Extensions to the lighting system at a cost of $10,000 are contemplated. A gas plant is in operation, the capacity of the main holder being 60,000 ft. and of the relief holder 20,000 ft. Extensions contemplated this year consist of a coal gas bench house and a 200,000 feet gas holder at an estimated cost of $40,000.

Campbellford, Ont.

This town, which was incorporated in 1906, has a population of 3,250. Its assessment in 1913 was $1,300,000 and the tax rate 20 mills. The building operations carried out five years ago totalled in value over half a million dollars. The town has twelve miles of macadamized roadways and the expenditure on road work this season will be $2,500. The sewerage system consists of two trunk sewers which empty into the Trent River. Water for domestic purposes is obtained from wells and for fire protection from the Trent River. Extensions to the electric lighting systems amounting to $17,000, are contemplated.

Carleton Place, Ont.

This town was incorporated in 1890. Its population of slightly over 4,000 five years ago has remained practically constant. The assessment last year was $1,310,156 and the tax rate 30 mills. Last year, constructional work amounting in value to $921,445 was carried out. There are ten miles of roadways, all macadamized, and about fifteen miles of granolithic sidewalks. In 1911 the town council took up the question of water supply and sewerage and having received an estimate of the probable cost submitted a by-law, which was carried. The following year plans were prepared and the contract awarded, which included the laying of about four miles of sewers and water mains. The pipe used for the latter are of steel. About three miles have been completed. Drawings and specifications for a pumping station, intake pipe, pumping machinery, filtration plant, steel water tower and sewage disposal works are in course of preparation, and contracts for these works will be let in the near future. The sewage disposal works will include sedimentation tanks in duplicate, sludge beds, chlorination house, effluent pipe, etc. The design of the tanks will be of the Imhoff type. The system will cost about $180,000. Upon the completion of these works the town contemplates the expenditure of a further sum of $50,000 on extensions. The water supply will be drawn from the river. The steel water tower to be located near the pump house will take care of the reserve supply. Regarding road building and other public works, the town will do little in the way of improvements this year, but a large expenditure in this respect is contemplated next year.

Cobalt, Ont.

Incorporated in 1906, Cobalt has a population slightly over 5,000. Last year's assessment was $4,021,153 and the tax rate 27 mills. The building programme this season is estimated to total in value $650,000. It is the intention to expend $110,000 on improvements to the six miles of streets during 1914. The garbage is collected by contract and disposed of by incineration. The water supply is drawn from the Sasaginaga Lake and is pumped by three centrifugal pumps having a total capacity of 1,800 gals. a minute.

Cobourg, Ont.

Incorporated as a town in 1850, Cobourg has a population to-day slightly under 5,300. Its assessment is roughly $2,200,000 and its tax rate for 1914 is estimated at 24 mills. There are thirty miles of streets, but so far no permanent improvements have been carried out. An expenditure of $60,000 during 1914 will be made. The sewerage system is of the ordinary type, the sewage emptying into the harbor. The Cobourg Utilities Corporation supplies the water, which is drawn from Lake Ontario. The plant consists of three 500,000-gal pressure filters.

Cornwall, Ont.

Cornwall came into existence as a town in 1847 and the population now stands at 6,500. The assessment last year was $2,100,000. The general tax rate for 1913 was 21 mills. The building estimate for the present season amounts to $10,000, an equal sum being the estimated outlay by the Engineering Department. The town has six miles of macadam and tarvia roadways and $5,000 will be expended in this department during the present year. The combined system of sewerage is in operation, disposal being into the St. Lawrence River. Garbage is collected in carts and disposed of on a dumping ground. The water supply is from the St. Lawrence River at a point some distance above the town, the plant consisting of a pump of 2,000,000 gals. capacity water tower, steel standpipe and cast iron mains. Extensions are contemplated at an estimated cost of about $3,000. A private company operates the electric lighting system in the town.

Dundas, Ont.

This town was incorporated in 1847 and has a population slightly over 4,600—an increase of some six hundred in five years. The assessment in 1913 was $2,036,600 and the tax rate in the same period 28 7/10 mills. It is estimated that $100,000 will be expended in building during the present year and $500 on engineering work. The town has twenty miles of macadam roadways. No regular sewerage system is in operation, but a special committee of the council are collecting data with a view to recommending a system for the town. A by-law at present under consideration provides for the systematic collection and disposal of garbage. The water supply is derived from springs and from Dundas Creek and is filtered mechanically.

Dunville, Ont.

Incorporated a town in 1900, Dunnville has a population of 3,330. The assessment is $1,791,325, and the tax rate last year was 25 mills. There are six and one-half miles of sewers, but there is no regular system of disposal. Extensions this season have been provided at an estimated cost of $25,000. The garbage is disposed of on a dumping ground. The water supply is from the Grand River. Last year $24,000 was expended on the waterworks system.

Fergus, Ont.

The population of Fergus is estimated at 1,700 and the town is assessed at about $800,000. The tax rate for the present year is not yet available. Building work for 1914 is estimated to total in value $60,000, and road improvements this season will involve an outlay of about $3,000, the composition of the streets being gravel and water-bound macadam. A waterworks system was installed last year, the source of the supply being artesian wells. Extensions have been planned for the present year at a probable cost of $2,000. Hydro-electric power will be in operation in the town before the end of 1914.

Fort Frances, Ont.

Fort Frances was incorporated a town in 1903 and has a population estimated at 3,000. The 1913 assessment was $2,615,000 and its tax rate 25 mills. The building programme last year totalled in value $1,209,190—an increase of nearly $1,000,000 over that of five years ago. There are over thirteen miles of roadways, composed of stone, earth and gravel, and the estimated outlay in this department this season will total about $5,000. The sewerage consists of 3.88 miles of piping, direct to the Rainy River. Extensions to the plant this year provide for some 6,000 feet at a probable cost of $10,200. The garbage is collected by wagons and dumped. The water supply is taken from the Rainy River, the plant comprising one reciprocating pump of 600 gals. capacity (driven by gas engine) and one electrically-driven turbine pump of 300 gals. capacity. Extensions planned include one electrically-driven 600-gal. pump and the laying of 15,200 ft. of 6-in. mains.

Goderich, Ont.

This town was incorporated in 1850 and its population is about 5,000. The assessment last year was $2,287,157. The roads are gravel and macadam. There is a combined system of sewerage. The sewage empties into Lake Huron, about one mile outside the town. The town's water supply is from Lake Huron and is conveyed by gravitation to settling basins and pumped to a standpipe. An expenditure of $35,000 was made recently in completing the installation of a hydro-electric system.

Haileybury, Ont.

Incorporated as a town in 1904, Haileybury has advanced in population from 2,737 in 1909 to 4,000 to-day. The assessment this year is estimated at two and one-quarter million dollars and the tax rate will probably be thirty mills. The value of building five years ago was $663,600 and the expenditure this season is estimated at $125,000. The town has 21½ miles of roadways, classified thus:—macadam, 1½; clay and gravel, 11; partly graded, 9. The expenditure on road development during 1914 is estimated at $75,000. The separate system of sewerage is in operation, the sewage being disposed of in septic tanks. There is a weekly collection of garbage—disposed of by incineration. The water supply is from Lake Temiskaming, the water being filtered mechanically. The waterworks will be extended at an estimated cost of $10,000.

Hawkesbury, Ont.

Hawkesbury was incorporated a town in 1896 and its population in 1913 was 4,374. The assessment last year was $1,061,301. The value of building last year was $652,900. There are approximately seven miles of roadways, the main street of the town being macadamized. A system of sewerage is in operation, the sewage being emptied into the Ottawa River. The collection of garbage is looked after by the local board of health. The water supply is pumped from the Ottawa River, one mile from the town, to a tank of [illegible] gals. capacity.

Kenora, Ont.

The date of Kenora's incorporation as a town is 1895. Its population to-day is 6,040, its assessment $3,351,835, and its tax rate 25 mills. Five years ago the value of building totalled $[illegible] and the estimated value for similar work this season is $[illegible]. There are thirty-[illegible] miles of macadam roadways and the sum of $[illegible] has been set aside for road improvements during 1914. The sewage is at present disposed of in Rat Portage Bay and Winnipeg River. The construction of a new sewerage system and disposal plant is contemplated, plans having been approved by the Provincial Board of Health. The garbage is dumped at present, but an incinerator plant is to be installed in the near future. The water supply is from Lake of the Woods. The water is conveyed by gravity into a well and pumped by electric power. A steam auxiliary pumping system is in use. Extensions to the electric lighting system will probably be made during 1914.

Kincardine, Ont.

Incorporated a town in 1875, Kincardine has a population of over 2,300, an assessment of $745,000 and a tax rate of 32 mills. The town expended some $46,000 on street improvements last year. The source of the water supply is Lake Huron.

Merritton, Ont.

Merritton was incorporated in 1874. Its population is slightly in excess of 2,000 and its assessment this year is $775,994. The tax rate for 1914 is 23 mills. About $460,000 represents the estimated value of building work for 1914 and $500 the engineering work. There are three miles of macadam roadways. The installation of a sewerage plant is under consideration. The water supply is from Lake Erie, and waterworks extensions to the amount of $2,000 are in contemplation. The electric street lighting will be extended at an estimated outlay of $1,200.

Mitchell, Ont.

Mitchell was incorporated a town in 1874. Its population last year was slightly below 2,000. The assessment in 1913 was $828,907 and the tax rate 24 mills. The value of building to be carried out this season is estimated at $600,000. There are twenty-five miles of gravel roads in the town and an expenditure of $6,000 is contemplated. There is no sewerage system. The water supply for domestic purposes is supplied from artesian wells and for fire purposes from the Thames River.

Mount Forest, Ont.

This town was incorporated in 1880 and the present population is slightly under 2,000. The assessment is $750,000 and the tax rate 27 mills. The sum of $2,000 was expended in 1913 on impovements to streets and roads, all of which are of crushed stone and gravel. Water is obtained from artesian wells.

Napanee, Ont.

Incorporated as a town in 1864, Napanee has a population of 3,000, an assessment roll of $1,355,487 and a tax rate of twenty-eight mills. The roadways are macadam. The sewage disposal plant consists of slow sand filters, the effluent being conveyed to the Napanee River. A couple of short sewers are to be constructed at an expenditure of about $2,500. Water for domestic purposes is obtained from wells, and for fire protection and other purposes the supply is derived from the Napanee River and furnished to the town by the Napanee Waterworks Company.

Newmarket, Ont.

The town of Newmarket received its charter of incorporation in 1881. It has a population of 3,700 and its assessment in 1913 was $1,300,000. The water supply is obtained from artesian wells. Extensions contemplated this season include the sinking of additional wells.

Orangeville, Ont.

This town was incorporated in [illegible]. Its population based on last year's estimate is [illegible], and for the same year its assessment was $[illegible]. Its tax rate for [illegible] was [illegible] mills. A total of $30,000 on building and $5,000 on engineering work is the expenditure estimated for the present year. There are ten miles of clay roads, upon which an outlay of [illegible] will be made this season. The water supply is from springs. From a watershed two miles beyond the centre of the town the water is conveyed by gravity, with pressure from pumps for fire purposes. An addition is to be put in this year at an estimated outlay of $5,000.

Oshawa, Ont.

Incorporated in 1878, Oshawa has a population of 8,248, an assessment of practically three and one-quarter million dollars, and a tax rate (last year) of 29 mills. The estimated value of building work this season is $150,000, against $134,000 in 1910. In engineering work, $53,000 is the expenditure estimated for 1914, against $27,719 in 1909 and $55,681 last year. The town has twenty-six miles of paved streets, the classification being: asphalt block, bitulithic, vitrified brick, concrete and macadam, to the extent of about six miles, the remaining twenty miles being graded and gravelled. The municipality intends laying about one mile of concrete road in the northern and western sections of the town during 1914, at an estimated outlay of $11,000. There is a separate sewerage system. The disposal is by sedimentation tanks of 100,000 gal. capacity. Garbage is deposited on a dump. Lake Ontario is the source of the water supply, which is conveyed by a 12-in. intake extending 1,130 feet into the lake. A water tower capable of holding 250,000 gallons also forms part of the plant.

Parry Sound, Ont.

Incorporated as a town in 1889, Parry Sound has a population of 3,300. Its assessment is $1,764,000 and its tax rate last year was 21 mills. The value of last year's building programme totalled $1,023,995. A bylaw is being submitted to the ratepayers to expend $26,000 on improvements to streets and sidewalks. There are sanitary sewers on the principal streets. The Georgian Bay is the source of the water supply, which is pumped to a steel tank. If the bylaw meets with the approval of the ratepayers, an expenditure of $7,000 will be made in extensions to the system.

Pembroke, Ont.

In 1877 Pembroke received its charter as a town. In 1909 its population was 5,600 and at the present time it is 7,000. The assessment is $3,169,730 compared with $2,534,265 five years ago. Its tax rate for 1914 is 25 mills. The value of building to be carried out this season is estimated to total $212,000, and engineering work $30,000. The roadways are water-bound macadam. There is a separate system of sewerage, the sewage being discharged into the Ottawa River. Garbage is collected in carts and deposited on a dump. The Ottawa River furnishes the water supply, which is taken through an 18-in. steel intake, motor-driven turbine pump, with auxiliary steam pumps, steel and cast iron pipes. Extensions to the distribution system are contemplated at an outlay of $5,000.

Petrolia, Ont.

Petrolia came into existence as a town in 1874. Its population has advanced from 3,670 five years ago to 4,019 today. Its assessment is $1,542,270 and its tax rate for 1913 was 31 3/5 mills. The 1914 building programme is estimated to total in value $75,000, and that of engineering work $10,000. The town possesses ten miles of roadways, made up of eight miles of ordinary clay roads, one mile of vitrified brick and one mile of asphalt. The sewerage system comprises four main trunk sewers emptying into Bear Creek. There is no regular system of garbage collection. The town's water supply is pumped from Lake Huron, a distance of fourteen miles, conveyed through a 12-in. main, with standpipe capacity of 250,000 gals. The capacity of the pumps at Lake Huron is 1,000,000 gals. daily.

Prescott, Ont.

Prescott has a population of 3,000 and an assessment of $1,314,207. Its date of incorporation as a town is 1860 and its tax rate—on last year's estimate—is 27½ mills. Of ten miles of streets one mile is macadam, the balance being ordinary surface. An expenditure of $1,000 will be made in road improvements this year. There is an ordinary system of sewerage, the sewage emptying into the St. Lawrence River. The water supply is obtained direct from the St. Lawrence River.

St. Mary's, Ont.

This town has a population of practically 4,000 and an assessment of about $2,000,000. The total value of building work this season is estimated at approximately $200,000. Four artesian wells furnish the water supply, which is pumped into a standpipe. There are steam and electric pumps, each of 1,000,000 gals. capacity. Minor extensions to the waterworks will be made this season. A new street lighting system will be installed in the near future.

Sarnia, Ont.

This town was incorporated in 1857 and application for a city charter is being made this year. The population last year was 11,000 and the assessment $5,271,600, with a tax rate of 26¼ mills. The value of building carried out last year totalled $3,044,555, the expenditure on engineering work being $10,000. There are forty miles of roadways, their composition being creosote, wood block, asphalt block, brick, concrete and earth. The sum of $200,000 has been set aside for road improvements this season. The sewerage system comprises three main outlets to the River St. Clair. It is proposed to expend $22,000 on the construction of a 60-in. concrete pipe, at an estimated cost of $14,000, and 24-in. sewer tile, at an outlay of $8,000. A garbage incinerator will probably be constructed this year. The water supply is drawn from the River St. Clair. The water is pumped by a 5,000,000-gal. Inglis reciprocating pump and a 3,000,000-gal. Worthington pump. It is proposed to expend $220,000 on extensions to the plant by constructing—an open filtration gallery and reservoir, at a cost of $65,000; pumping plant consisting of steam turbine-driven pump of 6,000,000 gals. capacity and one Inglis reciprocating pump of 5,000,000 gals. capacity, at an estimated value of $75,000. A 24-in. steel main will also be laid at an expenditure of $80,000.

Seaforth, Ont.

This town has a population of 2,000 and was incorporated in 1874. The assessment for 1914 is $960,000 and the tax rate (last year) was 31 mills. The streets are of asphalt block, macadam and gravel, and the water supply has its source in Silver Creek.

Smith's Falls, Ont.

Smith's Falls was incorporated as a town in 1883. It has a population of 6,550, an assessment of $3,700,000 and a tax rate of 21½ mills. The value of building last year amounted to $222,000 and the building programme for the present season is estimated to amount in value to $100,000. Five years ago the engineering department expended $20,000, chiefly on sewers and walks. Last year the outlay by the engineering department was $38,000 and for 1914 the amount estimated is $20,000. The town possesses about forty miles of roadways, all of which are macadamized, and $100,000 has been set aside for road improvements this year. There is a combined sewerage system, the sewage being disposed of in the Rideau River, from which source the town's water supply is also drawn.

Steelton, Ont.

Steelton was incorporated a town in 1904. Its population of 2,700 in 1909 has increased to 5,506 to-day. The assessment this year is $2,661,706, of which $1,991,180 is covered by specific tax paid by the Algoma Steel Company's Industrial Works. The roads are slag, tar macadam and concrete. The sewage is disposed of untreated into the St. Mary's River. Extensions to involve an outlay of $27,000 will be carried out in the eastern and western sections of the town. The source of the water supply is the St. Mary's River. Water is purchased from the Tagona Water & Light Company, who supply the city of Sault Ste. Marie. The feasibility of an artesian well supply is being investigated and if found practicable a pumping plant will be installed.

Strathroy, Ont.

The population of Strathroy is slightly over 3,000. Last year's assessment was $1,151,735 and the tax rate 25 mills. The value of building done five years ago represented a total of $124,800, as against $992,530 last year. Twenty miles of roads, sand and block paved. There is a sewerage system in operation. The garbage is dumped. The water supply is drawn from artesian wells. An expenditure of $25,000 on a hydro-electric installation is contemplated.

Sudbury, Ont.

Incorporated as a town in 1894, Sudbury has exactly doubled its population, which in 1909 stood at 4,000 and which to-day is 8,000. The assessment for the previous year is three and one-half millions, against $1,700,000 five years ago. The tax rate last year was 12.5 mills. The value of building done in 1909 was $250,000 and the estimated total for this season is $1,000,000. The expenditure estimated under the head of engineering is $150,000. There are thirty miles of roadways, composed of rocmac, macadam, gravel and earth. An expenditure of $150,000 on road improvement this year is estimated. The sewerage system comprises one main trunk sewer with laterals. For the lake section there is a pumping plant, compressed air and Priestman ejectors being in use, the sewage discharging into the trunk sewer. The provision of sedimentation tanks is contemplated and other proposed improvements in the system embrace the extension of the trunk sewer and the construction of additional sanitary street sewers. The garbage is dumped. The water supply is obtained from Ramsay Lake within the town limits, the plant consisting of a pumping station, two motor-driven turbine pumps of 1,440,000 gals. daily capacity, two compound steam pumps of 3,168,000 gals. capacity and one steel elevated tank having a capacity of 64,000 gals. Extensions to the waterworks plant will be made at an estimated cost of $10,000. A similar amount will be expended on ornamental street lighting.

Tilsonburg, Ont.

Tilsonburg was incorporated a town in 1872. Its population of 2,200 five years ago has advanced to 3,000. Its assessment for 1911 is $1,500,000 and the tax rate 23 mills. The total value of building done in 1909 was [illegible]. The estimated value of the building programme for this season is $1,000,000. There are ten miles of streets and roadways, a large percentage of which are macadam. The town sewage is disposed of in sedimentation tanks. The water supply is obtained from springs.

Walkerville, Ont.

The town was incorporated in 1890 and has a population of 5,000. Its tax rate this year is 10 mills. The expenditures on engineering work this season is expected to total close on to $25,000. There are practically fourteen miles of roads, classified as follows:—asphalt block, bitulithic, cedar block and concrete. The town is served by a main drainage system, the sewage being discharged into the Detroit River. Extensions planned consist of the construction of about 3,000 ft. of sewer at an estimated cost of $4,800. Garbage is collected in wagons and disposed of by incineration. The source of water supply is the Detroit River.

Waterford, Ont.

Waterford has a population slightly over 1,000, an assessment of $491,000, and a tax rate of about 20 mills. About ten miles of gravel roads are controlled by the local authority and the water supply is drawn from wells. No constructional improvements of any kind are contemplated this year.

Welland, Ont.

Welland came into existence as a town in 1878. It has a population of 8,000, which is practically double that of five years ago. The estimated assessment for the present year is $4,888,525, and its tax rate is 25 mills. The expenditure on building this season will probably reach three-quarters of a million dollars. The road mileage is 22, 18 of which are earth 2 of brick, 1½ macadam and ½ mile slag. The sum of $30,000 has been set aside for road improvements this season. Welland has a combined system of sewerage, the sewage being disposed of in the river. There will probably be an expenditure of $15,000 on sewerage extensions this year. Garbage is collected weekly and dumped outside of town limits. The Welland Canal is the source of the water supply. Waterworks extensions will involve an outlay of about $12,000. The electric lighting plant will be extended at an estimated cost of $20,000.

Weston, Ont.

This suburb of Toronto, which is now a town of some twenty-five hundred inhabitants, was first incorporated as a village in 1883. The assessment last year was $1,444,466. The tax rate this year is 22½ mills. There are fifteen miles of macadam and gravel roadways at Weston. The sewerage system consists of about ten miles of sanitary sewers, a storm sewer on Main street and a 26-in. storm trunk sewer one mile in length. The method of disposal is by sedimentation and revolving sprinklers with stone filter. The garbage is deposited on a dump. Water is obtained from the Humber River and subjected to mechanical filtration. Extensions to the waterworks this year will cost $2,000 and to the electric light plant, $10,000.

Manitoba

Brandon, Man.

The city of Brandon was incorporated in 1885. It has a population of 18,000, an increase of more than fifty per cent. in the last five years, during which period the assessment has increased from nine and one-half millions to more than fourteen millions. In 1909 the value of building work carried out was $250,000 as compared with an estimate of $1,000,000 for 1911. The engineering expenditure for 1909 was $205,000. No complete estimate of municipal engineering work for 1911 is obtainable at the time of writing, but $75,000 will be spent on roadways, $80,000 on sewerage extensions and $120,000 on waterworks. The roadway mileage is fifty-four, made up as follows:—graded and gravelled roads, 23; graded only, 27; asphalt block, 3; rocmac, one-half; macadam, one-half. The city is divided into four sewer districts, and the sewerage is the combined system. At present the sewage is discharged into the Assiniboine River. The city contemplates putting in a sewage disposal system at a cost of $80,000. The garbage is collected by the city and deposited on a nuisance ground. The purchase of an incinerator is under consideration. The city's water supply is from the Assiniboine River. Mechanical pressure filters are used and settling basins with gravity filters are contemplated.

Carman, Man.

The town of Carman was incorporated in 1905. Its population of 1,300 in 1909 has increased 300 in the five years to date, and in the same period its assessment has increased from $676,000 to $900,000. The 1914 tax rate will be probably 24 or 25 mills. The estimate for building work this year is $75,000. There are about seven miles of earth roads. Fifteen hundred dollars will be spent on road work this season. The sewage empties into the Boyne River. The garbage is deposited on a nuisance ground and burned. The town's water is obtained from wells, water required for fire protection and other purposes being pumped from the river to an elevated tank.

Emerson, Man.

Emerson was incorporated a town in 1889. Its population is practically 1,000 and its assessment last year was $404,000. There are thirty miles of earth roads, on which $1,500 will be expended this season. The water supply is derived from wells and from the Red River. An expenditure of $200,000 on an electric lighting plant is contemplated.

Minnedosa, Man.

This town, which has a population of 2,000, received its charter in 1885. During the last five years the population has increased 650. The assessment and tax rate last year were $1,557,000 and 21 mills respectively. It is estimated that $10,000 will be expended on building and engineering work this season, the amount being equally divided. There are 12 miles of earth roadways. The water supply is from wells. There is no sewerage system. The garbage is dumped.

Neepawa, Man.

This town received its charter in 1884. It has a population of 2,300 and its assessment is $1,210,000 as compared with a population of 1850 and an assessment of $813,200 in 1909. The tax rate last year was 28 mills. During 1912 and 1913 the engineering work carried out by the municipality represented an expenditure of $146,000, and the 1914 estimate is $50,000. The sum of $5,000 will be expended on road work this year. The town has fifteen miles of gravelled roads. The method of sewerage disposal is by septic tank and filtration. Sewerage extensions to the value of $5,000 will be made this season. Garbage is collected by teams and burned. The water supply is pumped from the river and is filtered. The waterworks extensions planned this season will cost $5,000. The electric light system is to be enlarged at a cost of $18,000.

Portage la Prairie, Man.

Portage la Prairie became a town in 1881 and a city in 1907. Its population of 6,490 in 1909 has increased to 7,000 to-day. The assessment in 1913 was $6,000,000, and the tax rate this year is about 24 mills. The city has about thirty miles of ordinary graded roads and contemplates an expenditure of $9,000 on street and road improvements this year. The sewage is pumped and discharged into the Assiniboine River. The source of the water supply is the Assiniboine River, the water being filtered through sand galleries.

Selkirk, Man.

The town of Selkirk was incorporated in 1882. Since 1909 its population has increased from 2,900 to 3,500, its assessment from $2,000,000 to more than $4,000,000, its building expenditure from $4,000 to $50,000 (estimate for 1914) and its municipal engineering expenditure from $4,500 to $60,000 (estimate for 1914). The 1913 tax rate was 19 mills. There are about eighteen miles of graded roads. The estimated expenditure on road work this season is $7,000. The sewage is discharged untreated into the Red River. The sewerage extensions contemplated will cost $16,450. The garbage is deposited upon nuisance grounds. The water supply is from a well. Waterworks extensions planned will cost $16,150. Extensions to the electric light system will be made this season at a cost of $5,000.

Souris, Man.

This town was incorporated ten years ago and has a population of 2,500—an increase of 900 since 1909. The assessment is $1,355,000 as compared with $755,000 in 1909. The 1914 tax rate is 26 mills. Building work to the value of $60,000 and municipal engineering work to the value of $18,000 are contemplated this season, these figures comparing with expenditures of $8,000 and $5,000 in 1909. The town has thirteen miles of gravelled roads and two miles of granolithic walks. Five thousand dollars will be expended on road work this season. The sewerage consists of eight miles of sewers 8-in. to 20-in. in diameter, with an inverted syphon under the Souris River, leading to the disposal works. Septic tanks and filter beds are used in the disposal of the sewage, the effluent being discharged into the Souris River after treatment. The extension of the sewerage in West Souris is to be carried out this year at a cost of $7,800. The garbage is collected under contract and is deposited on a nuisance ground. The water supply is from two wells 185 ft. deep. The town has two 82 h.p. pressure gas engines, and the water is raised from the wells by the Harris Air Lift system, after which it flows by gravity to the reservoir, which has a capacity of 90,000 gallons. Further equipment consists of two Worthington turbine pumps and compression tank system. Waterworks extensions to West Souris are planned at a cost of $6,900. The electric light system, which was installed last fall, is operated jointly with the waterworks plant. The system is direct current with storage battery manufactured by the Hart Accumulator Company, Limited, London, England.

St. Boniface, Man.

St. Boniface received its town charter in 1883 and its city charter just twenty-five years later. During the last five years its population has practically doubled, it having increased from 6,078 in 1909 to nearly 12,000 to-day, during which period the assessment has increased from nine and one-half millions to over eighteen millions. The expenditure on building work in 1909 was $1,625,395 and on engineering work, $650,000. The 1914 estimates are rather less than $4,000,000 for building work and $175,000 for municipal engineering work, of which $600,000 will be spent on new bridges. There are seventeen miles of roadways in St. Boniface, the types being creosoted block, bitulithic, asphalt block and cedar blocks. The estimate for 1914 road work has not been taken up at the time of writing. The sewerage is the combined system, there being six outlets to the Red River. There are thirty-nine miles of sewers, of which six are trunk. Sewerage extensions contemplated this season involve an expenditure of $50,000. The garbage is collected in wagons and deposited on a dump. The water is pumped from four wells to an underground reservoir (capacity 1,000,000 gallons) by a motor-driven air compressor and air lift pumps. From the reservoir it is pumped into the city mains though an elevated tank 145 feet high by two motor turbine pumps having a capacity of 1,500,000 gallons every 24 hours under a pressure of 100 pounds per square inch. The substructure for the new bridge over the Red River between Winnipeg and St. Boniface is almost completed and tenders are now being called (close June 20) for the superstructure. This will be a half-through plate girder bridge with a two-leaf Strauss bascule bridge lift span, and will cost approximately $600,000, of which the city of Winnipeg will pay one-third. The bridge has a 46-foot clear roadway and two 10-ft. sidewalks.

Winnipeg, Man.

The capital of Manitoba, the economic centre of the Canadian West, has grown from a Hudson's Bay trading post with a population of 215 to a city of 225,000 in 44 years. The city received its charter in 1874 when there were 1,869 inhabitants. Perhaps the most illuminating instance of the city's growth may be found in recent years, the population having increased from 122,390 in 1909 to 225,000 to-day. In 1909 the assessment was practically $108,000,000, while last year it was $260,000,000. The building permits issued in 1909 represented the expenditure of nine and a quarter millions, while the estimate for the present year is twenty millions. During the last seven years Winnipeg has expended approximately $150,000,000 in new buildings. The roadway mileage is 464, classified as follows: asphalt macadam, 13.5; sheet asphalt, 84.7; cedar block, 26.0; macadam, 33.1; concrete, 1.8; graded roads, 264.2; unimproved roads, 40.7. In the way of road work this season it is intended to carry out sheet asphalt paving (details of which are on file at the office of the Contract Record) totalling nearly 94,000 square yards. It is expected that 30,000 square yards of granolithic walk will be put down this year and 17 miles of plank sidewalks. The sewerage system, briefly, is a combined system discharging through twenty-five outlets into the Red and Assiniboine Rivers, the method of disposal being by dilution. The sewerage extensions planned this season involve an expenditure of $390,000, to be spent principally on the construction of laterals. While some sewers have already been constructed and others are under way, the specific work yet to be done has not been definitely decided upon. The garbage is collected in wagons and disposed of by incineration. The city has three incinerators:—No. 1, built by the Toronto Furnace Company, has a capacity of 60 tons a day; No. 2, built by the city, has a capacity of 100 tons a day, and No. 3, built by the Decarie Company, has a capacity of 160 tons a day. The city's water supply is obtained from artesian wells. The waterworks extensions planned this year will cost $385,000. This amount includes $195,000 for mains (details not decided on), $30,000 for meters, and $60,000 for new services. Besides this, $300,000 will be expended on extensions to 36-inch pipe line and well system. The distribution of the one-million-dollar appropriation for electric light and power extensions has not been detailed. In all probability $700,000 will be expended on extensions to generating plant, transmission line, improvement of railroad (including a bridge) and the balance on extensions in the city, viz., overhead lines, new synchronous sets, and buildings.

Saskatchewan

Battleford, Sask.

This town has a population of 2,300 and was incorporated in 1904. The assessment is in the neighborhood of $4,500,000 and the tax rate 14 2-5 mills. Building work for the present season is estimated to total in value $150,000 and the amount set aside for engineering construction $100,000. There are five miles of streets and sidewalks, all of which are graded. It is proposed to expend $1,000 on road improvements this season. There are four miles of sewers discharging into the Battle River. The system of sewage disposal is by combination sedimentation tank and percolating filters, Ham Baker travelling distributors being used. Extension work is at present under construction at an estimated cost of $70,000. The garbage is collected by scavenger and dumped. The water supply is drawn from wells in the neighborhood of the Saskatchewan River. The system consists of duplicate submerged centrifugal pumps, pumping against a 100-ft. head to a reservoir of one hundred thousand gallons capacity, from whence it is conveyed by turbine pump to two 18,000-gal. tanks. Waterworks extensions will cost $25,000.

Canora, Sask.

Incorporated as a town in 1910, Canora has advanced in population from 300 in 1909 to 1,400 to-day. The assessment in 1913 was rather more than $2,000,000 and the tax rate 18 mills. The value of building during 1913 was $388,000. There are about four miles of gravel roadways. A sewerage system is being installed, also water supply, the source of which will be Crystal Lake, 14½ miles from the town.

Davidson, Sask.

This town was incorporated as recently as 1906. The population is 650, an increase of 200 in five years, during which time the assessment of $300,000 (in 1909) has doubled. The 1914 tax rate is 18 mills. Building operations this year are estimated to cost $20,000. Garbage is collected by scavengers and dumped. The town's water supply is from three main wells, with a motor pump in operation. The lighting system is to be extended this season at a cost of $10,000.

Lloydminster, Sask.

This town has a population of 1,000 (600 in 1909) and an assessed value of $554,000. The 1913 tax rate was 16 mills. The roadway mileage is nil and there are no systems of sewerage or garbage disposal. The water supply is obtained from wells and the electric light is furnished by private plant.

Melville, Sask.

Melville became a town in 1909. Its growth is evidenced by the fact that its population has advanced from 500 in 1909 to 3,500 to-day. The estimated assessment for 1914 is $3,750,000, and the tax rate 20 mills. The building programme this season is expected to total $350,000, while $150,000 has been set aside for engineering works. The mileage of graded roads is fifteen. Road improvements involving an expenditure of about $12,000 are contemplated. A regular sewerage system has not yet been constructed, but an installation at an actual outlay of $82,000 is planned. Garbage is collected by scavengers and dumped. The water supply is from deep wells distributed by means of air pressure tanks, or in case of fire pumped into the mains direct. Extensions to the waterworks system estimated to cost $13,000 will probably be made during 1914.

Moose Jaw, Sask.

In common with most western centres, Moose Jaw has advanced with marked rapidity. Incorporated a city in 1903, Moose Jaw had a population three years later of 6,250. This has now advanced to 30,000. The assessment last year was approximately $52,000,000 and the tax rate 17 mills. Details of building expenditure are not available, but it is estimated that $1,300,000 will be expended this season in engineering work. The mileage of streets and roadways is 180, apart from subdivisions, all roads being graded. An expenditure of $120,000 on road improvements is contemplated. The sewage is pumped to separator tanks, which, with percolating filters, are the method of disposal. The effluent undergoes a process of disinfection and the sludge is dried and burned. Extensive improvements to the system are contemplated at an outlay of practically $360,000, apportioned as follows:—extensions to sanitary sewers, $212,000; extensions to storm sewers, $115,000, and extensions to disposal plant, $30,000. The ratepayers have just approved a bylaw to raise $301,000 for sewerage and waterworks extensions, details of which are given in the News Department of this issue. The garbage is collected by city teams and disposed of by a Heenan & Froude about twenty miles west of Moose Jaw, an auxiliary suppl incinerator. The water supply is obtained from Sandy Creek, being available from Snowdy Springs, eight and one-half miles south-west of the city. The system comprises a tile infiltration gallery into which water filters through sand and gravel. Extensions comprising about ten miles of 6 in. to 12-in. mains are planned at an estimated outlay of practically $200,000. The electric lighting system will be extended at a cost of $155,000.

Moosomin, Sask.

The town of Mossomin was incorporated twenty-five years ago. It has developed slowly, the present population of 1,300 being an increase of only 100 in the last five years. The 1914 assessment is one and one-quarter million dollars and the tax rate this year is 25¾ mills. There are no municipal improvements with the exception of the waterworks the water supply being taken from a well and the equipment consisting of a 100,000 gal. standpipe. There is no electric light ystem, acetylene gas furnished by a private company being used.

North Battleford, Sask.

Incorporated as a town as recently as 1907, North Battleford received its city charter only last year. It has a population of nearly 7,000, compared with 1,500 in 1909. The assessment is roughly $10,000,000, as compared with $1,000,000 in 1909. In 1909 the value of municipal engineering work carried out was $60,000. This year's estimate is $350,000. The building work projected involves an outlay of $1,500,000. There are no permanent pavements in the city. The sum of $70,000 will be spent on grading and gravelling this season. A separate system of sewerage is installed, the method of disposal being by two sedimentation tanks, with sub-surface filtration for the tank effluent and two sludge beds. The sewerage system is to be extended this year by the installation of sewage filters at a cost of $8,000. Garbage is collected by the city and deposited on a nuisance ground. Water is obtained from wells on the bank of the Saskatchewan River. There is one steel well, 35 ft. in diameter and 25 ft. deep, and one concrete well, 25 ft. in diameter and 22 ft. deep, situated in sandy soil 50 ft. from the river bank. Water is pumped to the standpipe by electric and gasoline power and conveyed to the city, two miles distant, in one steel and one cast iron force main. The storage capacity is 500,000 Imp. gals. All the services are metered. This season it is planned to extend the waterworks system at a cost of $70,000 by enlarging the pumping station and adding to the distribution system. Extensions to the electric light system are to be made this year at a cost of $25,000, the new work to consist of pole lines and ornamental system. Additional boilers will be installed.

Prince Albert, Sask.

The town of Prince Albert came into existence in 1885 and received its charter as a city ten years ago. The population to-day is 13,500, as compared with 5,000 in 1909, the assessment being rather more than 31,000,000 as compared with five and a half millions in 1909. The 1913 tax rate was 11 mills. The value of building in 1909 was $142,000, while the 1914 estimate for building work is $1,750,000 and for municipal engineering work $250,000. In the construction field contracts for the new R. C. cathedral, armoury building and telephone exchange were let recently. The roadway mileage is 35, the classification being: earth, 33; gravel, 1; macadam, 1. All underground work, such as water and sewer services, conduits for carrying electric light and telephone wires, are being installed by the city with the idea of preparing a programme of constructing each year for the next few years about 50,000 sq. yds. of pavement. Plans and specifications are in course of preparation for removing the present grade crossings in the heart of the city and of placing the railway tracks just under the brow of the hill, crossing these tracks on the various avenues by reinforced concrete viaducts, the estimated final cost of the scheme being $800,000. The sewerage installed is a separate system. There are three pumping areas with a trunk sewer across the city. At present there is no method of disposing of the sewage, but a scheme is under consideration. The sewerage extensions planned this year involve an expenditure of $75,000. Garbage is collected by wagons and dumped on a nuisance ground. The water supply is drawn from the North Saskatchewan River. There is a mechanical filtration plant in operation. Extensions to the waterworks will be made this season at a cost of $125,000. The dam at LaColle Falls, situated twenty-five miles down the North Saskatchewan River from Prince Albert, has been partially completed by the city. The construction of this plant will render cheap power available for pumping purposes, electric light and power services, the street railway and also for the various mills and power users within the city. An Ottawa syndicate is at present in negotiation with the city to install a complete street railway system at an estimated cost of $250,000. In the event of satisfactory arrangements being made it is expected that work will start this summer and that six miles of railway will be in operation before the end of the year.

Regina, Sask.

The capital city of Saskatchewan was incorporated as a town in 1883 and as a city just twenty years later. The increase of population in recent years has been on the same spectacular scale as at Saskatoon, the figures for 1914 and 1909 being 50,000 and 12,000 respectively. The net assessment in 1909 was, roughly, $12,000,000, as compared with $73,000,000 to-day. The 1914 tax rate is estimated at 16 mills, the building expenditure at $4,000,000 and the municipal engineering work at $2,500,000. In 1909 the building work was valued at $750,000 and the engineering work at rather more than $300,000. The roadway mileage is 101, there being twenty-six miles of pavements, with the balance granolithic and plank sidewalks. The expenditure on road work this season is placed at $800,000. There are 61 miles of sewers with 5,100 house connections. A new separate system is in operation The method of disposal is sedimentation and filtration. The 114 extensions to the sewerage systems comprise two additional filters at a cost of $75,000, twelve miles of domestic sewers at a cost of $138,000 and seven and one-half miles of stone sewers at a cost of $170,000. The garbage is collected by the City Scavenging Department and transferred from a central refuse station over the street railway to an incinerating plant of 110 tons capacity. The city's water supply is from the Boggy Creek watershed. The city has one 5-million gallon reservoir, one 18-in. and one 10-in. supply main, and 59 miles of distributing mains. This season the water system is to be extended by thirteen miles of distributing mains, estimated to cost $120,000, while sewer and water connections and water meters will involve another $360,000. The electric light system is to be enlarged by line extensions, apparatus, buildings, etc., at a cost of $400,000.

Saskatoon, Sask.

Saskatoon is one of the whirlwind cities of the west, it having received its city charter in 1906 only three years after its incorporation as a town. Its population of 7,500 in 1909 has now increased to 30,000. Following are further comparative returns in round figures: assessment, 1909, $8,000,000; 1914, $54,000,000; value of building construction, 1909, $1,000,000, 1914 (estimated), $2,300,000; value of municipal engineering work, 1909, $423,000; 1914 (estimated), $634,000. The 1914 tax rate is estimated at 17½ mills. The roadway mileage is 58.63, made up as follows:—graded earth roads, 53; bitulithic pavement, 2.63; street asphalt, 1.41; sandstone block, .82; asphaltic concrete, .54; wood block, .23. The 1914 expenditure on road work is placed at $50,000. The city is situated on the banks of the South Saskatchewan River, along the north shore of which an intercepting sewer, 3 ft. by 6 ft. in diameter, has just been completed. This sewer intercepts all the sewer outlets in the city, with 24-in. inverted syphon and another 24-in. pipe line under the river, the latter to be pumped. These two pipe-lines carry the sewage across the river to the main interceptor, which will carry all the city's sewage to a point below the city where a disposal plant is to be constructed in the near future. The extensions planned this season comprise storm and sanitary sewers at a cost of $100,000. The garbage is collected by teams and burned in an open field. An incinerator plant is contemplated. The water is brought from the South Saskatchewan River through a 35-in. cast iron intake pipe and a 12-in. intake pipe into a shore well, from which it is raised by centrifugal pumps into a sedimentation basin. From this basin it flows by gravity to the filtration building, where it is purified in a plant constructed by the Roberts Filter Company, of Philadelphia. After filtration it flows to the pumping station and is forced into the distribution system by electrically-driven, centrifugal pumps. The extensions planned this season comprise a sedimentation basin, estimated to cost $60,000. Of the interesting work under contract special mention must be made of a reinforced concrete arch bridge 1,543 ft. long, the cost of which will be in the neighborhood of $500,000. The construction is composed of ten arch spans varying from 25 ft. to 150 ft. Extensions to the electric lighting system planned this season involve an outlay of $200,000.

Weyburn, Sask.

Incorporated as a town in 1903 and as a city in 1913, Weyburn has a population of 5,500, as compared with 1,100 in 1909. The assessment to-day is roughly $10,000,000. In 1909 it was one and one-quarter millions. Little has been done in the way of road work, but this year there will be an expenditure of $5,000 and an equal amount on concrete sidewalks. The sewers carry domestic sewage only and drain to an ejector station near the power house, where the sewage is pumped to the disposal works one mile distant. The sewage is passed through sedimentation tanks, filtered, and the effluent disinfected before being discharged into the Souris River. The sewerage extensions for 1914 will cost $32,000, made up as follows:—sewage filter, $15,000; street sewers, $15,000, and house connections, $2,000. Garbage is collected weekly by city teams and burned on a nuisance ground. Water is collected in wells and pumped to a water tower in the city. The waterworks extensions planned involve an expenditure of $40,000, and are as follows:—collecting gallery at wells, $30,000; street mains, $7,000; house connections, $3,000. Extensions to the electric light system will be made at a cost of $20,000.

Yorkton, Sask.

This town received its charter in 1900. Nine years later it had a population of about 1,250, which has grown to nearly 6,000. Last season's assessment was roughly $8,000,000 as compared with $1,300,000 in 1909. The tax rate for 1913 was 17 mills. The estimated expenditure on municipal engineering work this year is $375,000, this comparing with an outlay of $40,000 for 1909. There are twenty miles of gravel roadways. The sum of $4,000 will be expended on road work this season. There are nine miles of sewers. The disposal works consist of a sedimentation basin and Stoddart trays. This season's extensions comprise the completion of the outflow sewer, 42-in. in diameter and 5,600 ft. long, at a cost of $40,000 The garbage is deposited on a dump. The water supply is obtained from wells 55 ft. deep. There are eight and one-half miles of water mains. The installation of a new water supply from York Lake, four miles distant, is under consideration, the work involving an expenditure of $100,000 The electric light system is to be extended at a cost of $200,000 details being as follows:—new power house, 1,000 h.p. Diesel engined units and ornamental tungsten standards, pole line extensions.

(For Part III—Towns and Cities of Alberta and British Columbia—see next issue.)

Mr. Wilfrid Hollingworth, Deputy City Engineer of Hamilton

Mr. Wilfrid Hollingworth, A. M. Can. Soc. C. E., whose article on the Hamilton waterworks was an interesting feature of our last issue, is deputy city engineer of Hamilton, a position to which he was appointed in 1911. Mr. Hollingworth hails from Lincoln, Eng., where he received his professional training in the technical schools of that city and in a four years' apprenticeship to Mr. R. A. MacBriar, city engineer of Lincoln. Upon the completion of his apprenticeship he was appointed Resident Engineer on sewage disposal works in Gloucester, an extensive undertaking which comprised five separate plants on the Cameron system and fifteen miles of main sewers. Mr. Hollingworth left the Old World for the New in 1904 and coming to Toronto made connections with his profession as engineer in charge of the design and construction of a small hydro-electric plant for the Erindale Power Company. In 1905 he was appointed assistant engineer under Mr. C. H. Rust, and had charge of various municipal works, including the Woodbine sewage disposal plant and other special works. In 1908 he was placed in charge of the construction of the Toronto main drainage system, for which the sum of $2,400,000 had been appropriated. He remained in the service of the city of Toronto in the above capacity until 1911 when he succeeded to his present office in Hamilton under City Engineer Macallum. Mr. Hollingworth is well and favorably known in his profession among the younger and more aggressive set. He takes a keen interest in Society work.

Mr W Hollingworth

At Lethbridge, Alta., a new English church, hall and rectory are to be erected at a cost of $150,000. The architects are Messrs. Clemesha & Portnall of Regina.

The extent of local improvements in the various municipalities in Saskatchewan is shown by the fact that during the four months of existence of the Saskatchewan Local Government Board, debentures for $5,540,752 were authorized. Of that amount, school districts received authorization to issue debentures amounting to $689,225; rural telephone companies, $361,400; rural municipalities, $6,000; towns, $289,400; villages, $8,900, and cities, $4,185,827. Almost half the debentures being issued by the seven cities of Saskatchewan are those providing for local improvement works at Regina.

The Artistic Possibilities of Bonds and Mortars in Brickwork*

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Part I.

BRICK walls offer more varied architectural possibilities than they usually receive credit for, either from the architect or the builder, and in no respect is this more apparent than in lack of knowledge appertaining to the skilled use of bonds and mortars. There are many good architects and many good builders who have yet to learn that bonds and mortars do not concern merely the dull prosaic mechanics of cementing bricks together and building them into a solid wall, but that treated intelligently in connection with the textures and colors of the bricks themselves, they offer the most flattering artistic opportunities. Let the designer in brickwork but know what his building is to be and where it is to be—a modest or a pretentious dwelling in town or country, a great block in the metropolis, or a store in the village street, a city hall, a school of learning, or a temple of worship—and he has within his hands the fine warp and woof of bonds offering their patterns, and of mortars showing their interlacing lines of color, with which to weave the fitting garments of habitation for man.

Design in brickwork is based on an accurate knowledge of the mechanical processes of the bond. **Bond** may be defined as the method by which each brick in the wall is so placed that the entire wall, by the overlapping of the individual bricks upon each other forms one solid mass throughout its length and breadth. The bricks laid with the length of the wall, or the stretchers as they are called, secure by their overlap longitudinal bonding strength, while those laid across the width of the wall, or the headers, bond the wall transversely.

As a pure running bond, or one made up entirely of stretchers, provides only for longitudinal strength, we may be justified in saying that all structurally sound brickwork is based on either one of two methods of bonding, both of which systematically include headers with the stretchers throughout the courses. The first is known as English bond, and consists of alternating courses of headers and stretchers; the second is the Flemish bond, consisting of alternating headers and stretchers in every course, so arranged that the headers and stretchers in every other course, respectively, appear in vertical lines. All ornamental bonds are simply variations of these two fundamental forms.

It is essential, however, that the designer of ornamental brickwork should be cautioned not to confuse bond and pattern. Bond refers primarily to the arrangement of the bricks as they overlap each other from course to course. It is true, bond may be frequently used to make various patterns by this arrangement; but, in the strict sense of the term, pattern refers to the change, or the varied arrangement, of the brick texture or color used in the facing; so that in this way it may be possible to secure many patterns in identically the same bond. Pattern may also be produced by the handling of the mortar joint, or by the projection or recession of certain bricks from the plane of the wall—a form of pattern used especially in the Moorish and Spanish brickwork.

Running or stretcher bond (diagram 1) consists entirely of stretchers overlapping each other one half brick, that is, breaking joint evenly, with the vertical joints in alternate courses forming perpendicular lines. Obviously lacking inherent transverse strength, this bond is suitable for use in wall facing only, which must be tied to the backing by some artificial means. The questionable practice of using metal wall ties and the method of clipping the interior corners of the facing brick to permit the insertion of diagonal headers into the backing are illustrated in diagram 2; so also is the occasional use of a bonding brick, made of double width for this special purpose. To remedy the transverse weakness of this bond, a header—sometimes a Flemish—course is introduced at regular intervals, generally every sixth or eighth course, resulting in what is known as common bond (diagram 3 shown with three intervening courses), which affords a perfectly satisfactory bonding strength in the wall transversely as well as longitudinally. Another form of running bond is given in diagram 4. Here the stretchers overlap only a quarter brick, or are crossed one-half instead of being wholly crossed as in diagram 1. This bond is very rarely used for any large surface, but frequently occurs in two or three courses separated by a Flemish or a header course, approaching in its nature the common bond.

Diagram 5 shows a running header bond worked by the brick texture or color as a zigzag. In diagram 6 we have headers laid without any bond at all in vertical lines, producing a reticulated appearance and forming what is known as checker-board bond. Although it is sometimes used in wall surfaces, it is merely ornamental and does not strictly come under the definition of bond. It should properly be used only in panels or contained areas.

English bond (diagram 7) already mentioned as one of the two basic methods of bonding, consists of alternating courses of headers and stretchers, with headers centered on the stretchers which lie in vertical lines. The tinting of the diagram shows two possible patterns which may be obtained by change in color or texture of the brick. English bond presents serious practical difficulties in case two headers with the mortar joint, as may frequently happen, occupy a greater space than the length of the stretcher, thus making it exceedingly difficult to secure the desired alignment in the vertical joints.

English cross bond (diagram 8) referred to by some builders as Dutch or Dutch cross bond, is a modification of English bond in which the stretchers are crossed; that is, break joint evenly in the successive stretcher courses. The same practical difficulty applies to this as to English bond. Diagrams 7 and 8 are drawn so as to show two headers with the joint as being exactly equal in length to the stretcher. Diagram 8 shows two pattern arrangements which may be made

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* By the kind co-operation of The Hydraulic-Press Brick Company, St. Louis, Mo.

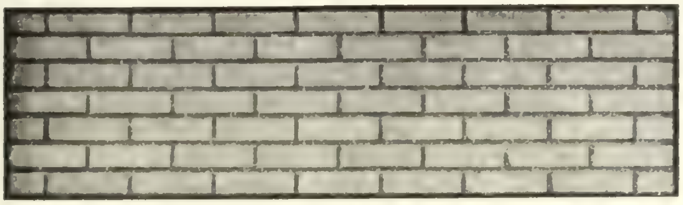


Diagram 1.

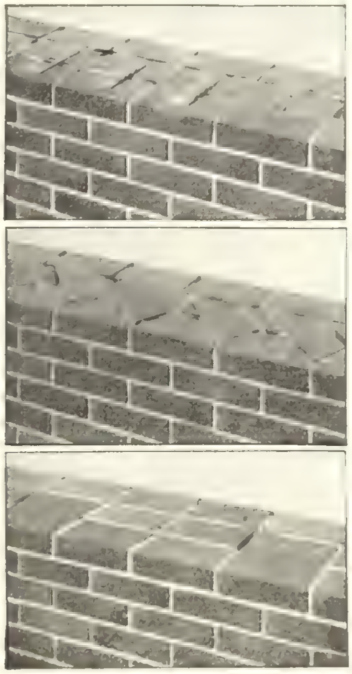


Diagram 2.

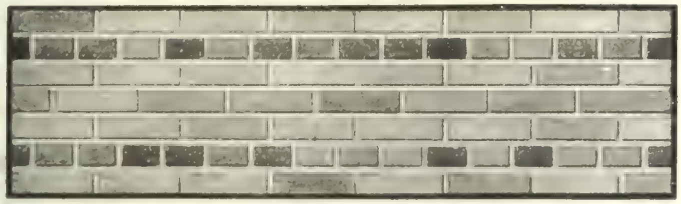


Diagram 3.

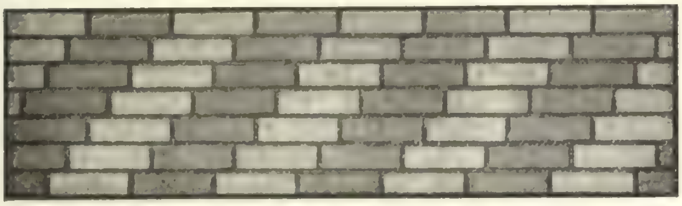


Diagram 4

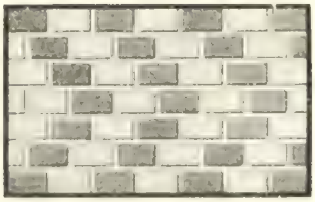
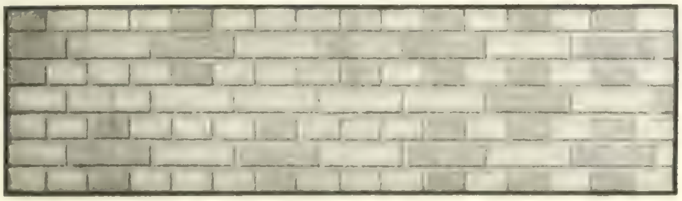


Diagram 5



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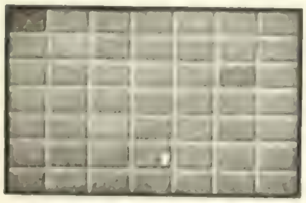

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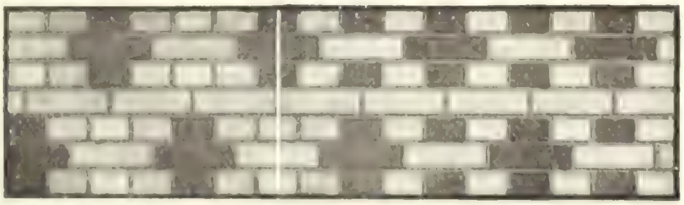

Diagram 8

The Artistic Possibilities of Bonds and Mortars in Brickwork.

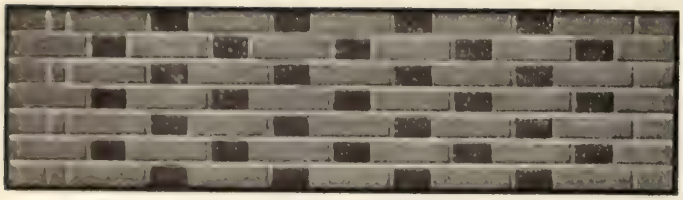

Diagram 9.

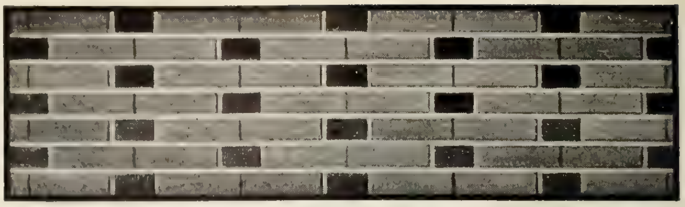

Diagram 10.

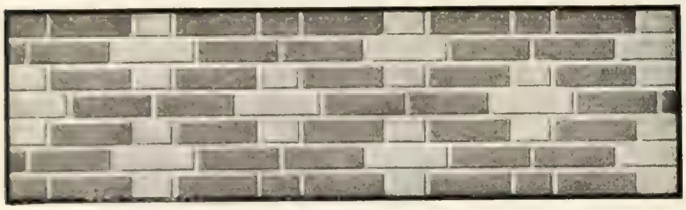

Diagram 11.

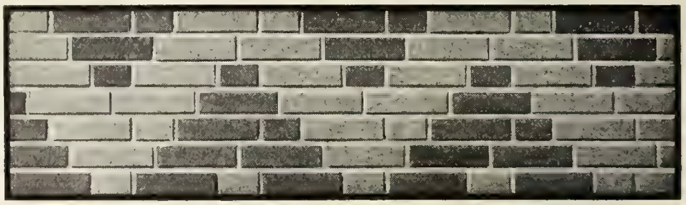

Diagram 12.

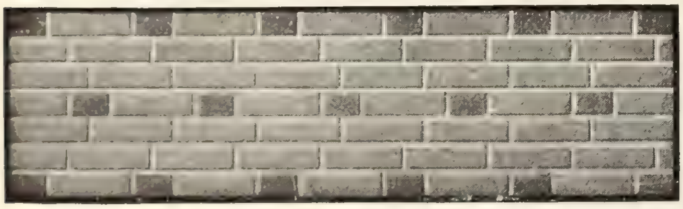

Diagram 13.

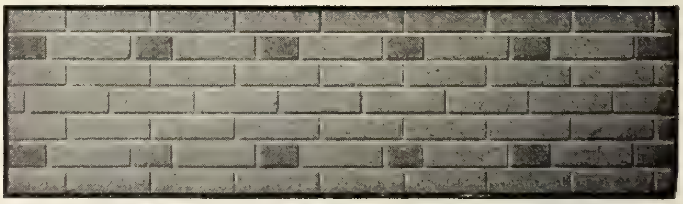

Diagram 14.

in English cross bond, dependent upon handling color or texture.

Flemish bond (diagram 9) already mentioned as the second basic method of bonding, consists of alternating headers and stretchers in all the courses of the wall, and these are known as Flemish courses. There are two legitimate methods of starting the corner in this bond, both of which are frequently used on the same work. The left end of the diagram shows the use of a quarter-brick, or "queen" closer, known as the "clip." The right end shows the use of the three-quarter brick, or "king" closer. There should be no variation in color, however, between the clip as shown on the left-hand edge and the general wall color of the course. Pattern in this bond should be made only by the headers. The closer at the corners should never be included as part of the pattern. It should be stated in passing that the brick designer must exercise great care in the use of his quarter-brick closer or clip in beginning or ending his courses at corners or edges of openings. He may without scruple begin or end his course with a three-quarter brick if necessary, but in case the clip is needed to complete the bond, it should never, except under the most pressing necessity of pattern requirements, be permitted to take the corner. Its best position is next the corner brick, as seen in the left-hand edge of the diagram.

Flemish bond may be modified by doubling the stretchers in every course (diagram 10) and centering the headers over the stretcher joints, which are always concealed or "blind"—in this particular alone differing from a double-stretcher garden wall bond (see under diagram 16).

Flemish bond with its variations is the basis of most pattern bond, which largely depends upon crossing the simple Flemish bond by first introducing variously crossed stretcher courses between the Flemish courses and then shifting the Flemish header in one of several different ways, or allowing it to remain in a vertical line.

Thus in diagram 11 we have the simplest form of Flemish cross bond which consists of alternating Flemish and stretcher courses with the headers in vertical lines and the stretcher courses crossed. In diagram 12 we have the same arrangement of crossed stretcher crosses, but the Flemish header departs from

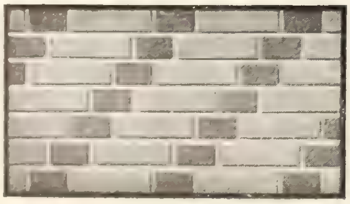

Diagram 15.

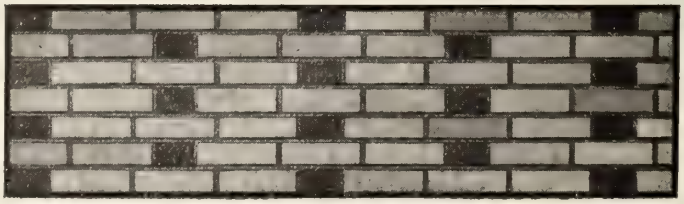

Diagram 16.

the vertical line by being shifted back and forth its width. This bond is the beginning of all diagonal pattern bonds, which owe their variation chiefly to the number and treatment of intervening stretcher courses, and to the way in which the header is shifted. In diagram 13 a Flemish course alternates with two stretcher courses which have an overlap of a quarter brick and reverse the diagonal direction of their vertical joints after every Flemish course, while the header is shifted back and forth three-quarters of a brick.

Diagram 14 represents a bond in which Flemish courses alternate with groups of three stretcher courses. This is a very satisfactory bond for average brickwork, as the headers are frequent enough to tie sufficiently the facing to the backing brick, and the work can easily be laid out so as to fit average building conditions without serious trouble (see under diagram 4 and diagram 3). Diagram 15 shows a Flemish spiral bond, having the Flemish courses laid out so that the headers break joint over each other and form diagonal bands on the face of the wall—a bond that is frequently used for stair-towers and chimneys.

In diagram 16 we have garden wall bond, which was originally used in eight-inch garden walls. Its value lies in its longitudinal strength, with sufficient transverse bonding secured by a symmetrical placing of the headers. By this arrangement a wall is laid in which both faces present a like bond surface. The diagram shows the original form of this bond, consisting properly of three stretchers alternating with a header in each course, although it is sometimes laid with two stretchers and a header—then designated as double-stretcher garden wall bond—in which case it forms the basis of double-stretcher Flemish bond, as given in diagram 10. Garden wall bond may also be laid with four or even five stretchers between the header.

Diagram 17 is a representation of garden wall cross bond, which consists of garden wall courses alternating with stretcher courses crossed. One form of pattern frequently used in this bond is indicated.

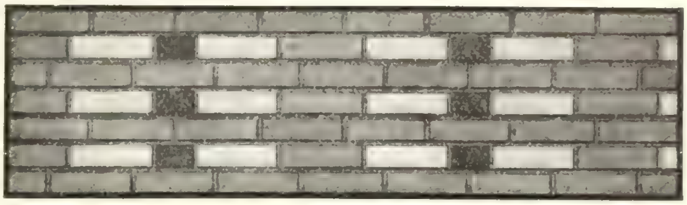

Diagram 17.

Bond Pattern Units

Diagram 18 represents the various units upon which diagonal bonds are based. Beginning with unit I, which is composed of a stretcher with a header centered above and below it, each succeeding unit is formed by extending every course of the preceding unit the width of a header, always centering the courses on the middle course regarded as the horizon-

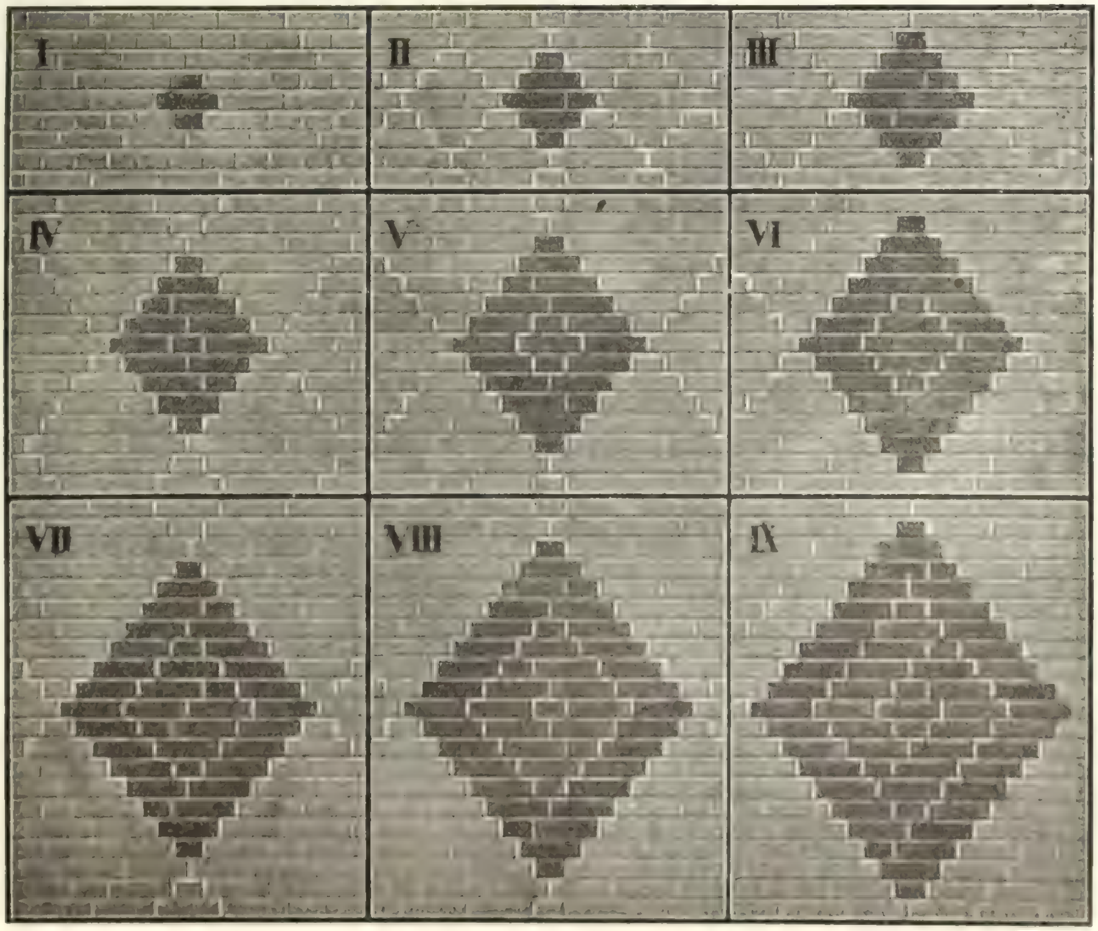

Diagram 18

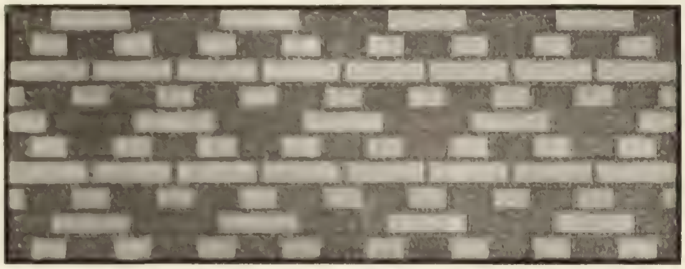

Diagram 19.

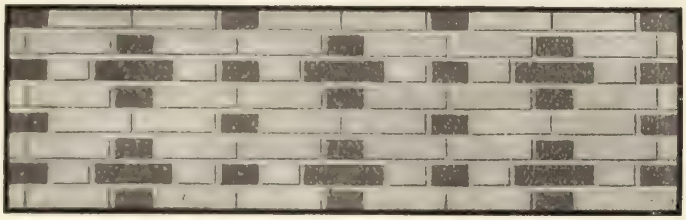

Diagram 20.

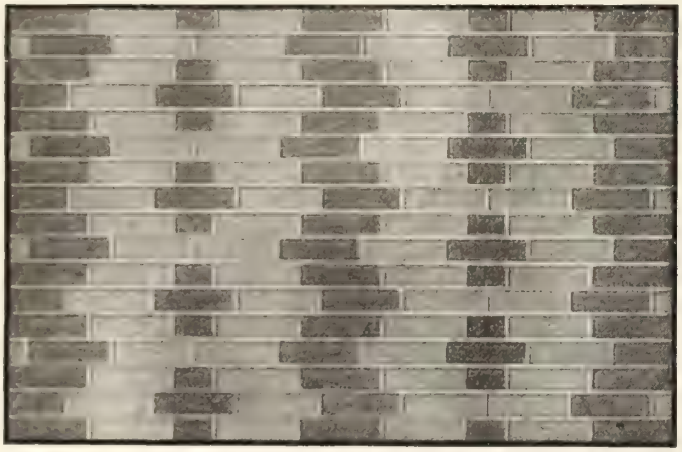

Diagram 21.

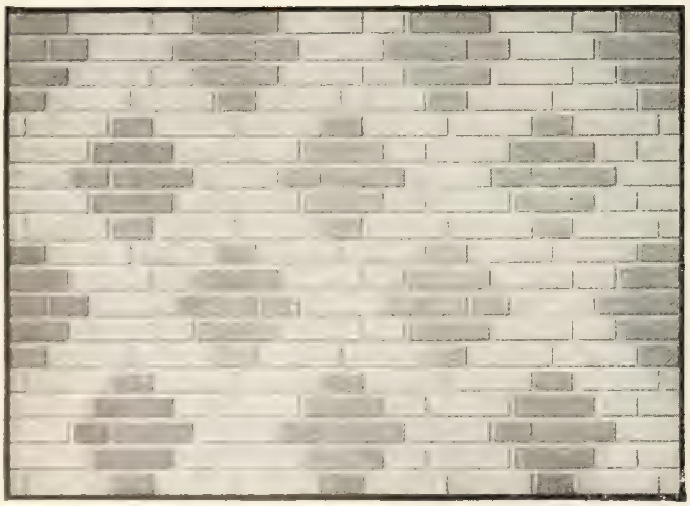

Diagram 24.

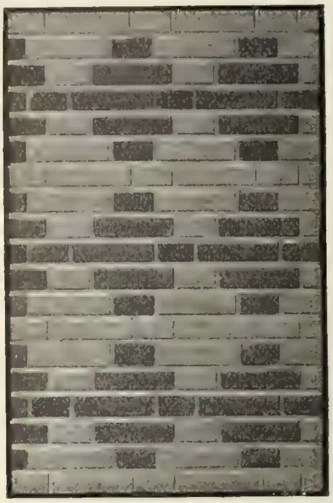

Diagram 22.

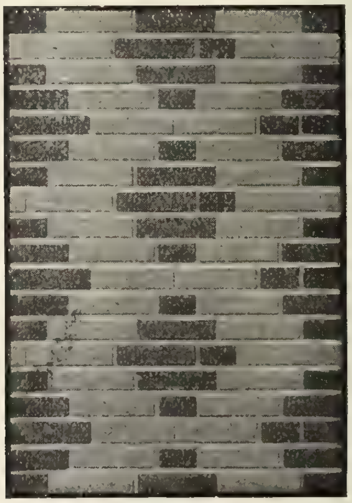

Diagram 23.

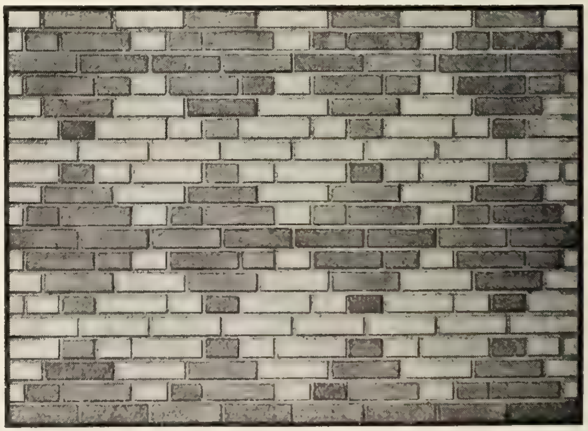

Diagram 25.

The Artistic Possibilities of Bonds and Mortars in Brickwork.

tal axis of the unit, and terminating the whole above and below by a header.

As a result the units, however far they may be carried out, always present exact mathematical proportions and bear a definite relation to each other. The serial number of any particular unit may at once be known by subtracting one from its number of courses and dividing by two; or, more simply, by counting the number of courses either above or below the horizontal axis. Conversely, the number of courses in any given unit may be known by doubling its serial number and adding one. Thus if we discovered in a brick wall a unit of nineteen courses, nine courses on either side of the horizontal axis, we should know that it was unit IX; or if we wished to use unit IX, we should always be obliged to have space for nineteen courses; and so on.

It is interesting to note further that the units may also be recognized by their horizontal axes, which in odd-numbered units are always composed entirely of stretchers, while in even-numbered units they always carry one, and only one, header, set as near their center as possible. The serial number of an even-numbered unit is double the number of stretchers in its axis, while that of an odd-numbered unit is one less than double the number of its axial stretchers. Thus if we see a unit with a horizontal axis of four stretchers only, we may be sure that it is odd-numbered unit VII; but if it have four stretchers and a header, we know that it is the even-numbered unit VIII.

With unit IV there begin to appear units within units. While the header, crossed by vertical stretcher joints, which appears at the center of Unit IV is not strictly a unit in our sense of the term, it is nevertheless the primary unit of all, as the smallest normal element in brickwork. Unit I clearly comes to view as the center of unit V; unit II appears in VI; unit III in VII; and so on. It is by the treatment of these units, each of which in itself is a bond pattern, that various patterns may be worked out on the surface of the wall by the proper handling of the color tones and textures in the brick, or of the mortar joints.

The units may be made to join, or "butt," each other vertically and horizontally; or they may be separated by introducing between them one or more courses above and below, or variously arranged rows of brick in a general vertical direction on the side, as may be seen in the following diagrams. When separated, the units are said to be surrounded by horizontal and vertical borders. And much of the artistic value of the pattern will depend upon the skill and taste with which these borders are worked out.

The designer in brickwork is urged to remember that the use of pattern bonds requires him to pay the strictest and most thoughtful attention to the beginning and ending of the pattern, either at the bottom or top of the structure, or on piers as they occur separately or between windows. He must first decide on a unit which is suitable to the size of the panel to be covered and then exactly center it upon the panel, so that his pattern may end in a symmetrical manner, both laterally and vertically. In order to secure vertical symmetry the panel must always have an odd number of courses, that is, an even number on each side of the median line.

Bond Units in Pattern

The accompanying diagrams offer a few suggestions of the way to handle the units and to treat the color tons and textures of the brick in designing patterns.

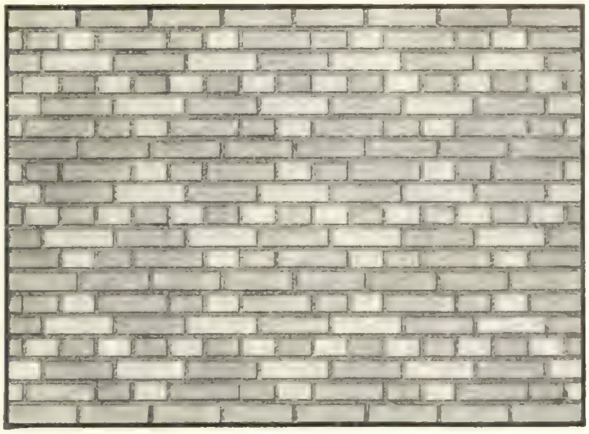

Diagram 26

Diagrams 19, 20 and 21 are readily seen to be examples of unit 1, which, if brought out in the design, always presents the appearance of a St. George's or Greek cross. Diagram 19 is, in bond, identical with diagram 8, or English cross bond, and differs from it only by the treatment of the colors in the brick, so arranged as to veil the definition of the units. By comparing the two, it will be seen what different patterns can be woven into the same bond. Diagram 20 is a sort of garden wall bond with the units and certain headers in vertical lines brought out by heightened tones in the color or texture of the brick. In diagram 21, consisting of alternating crossed stretcher and garden wall courses, the unit is also highly accentuated and surrounded by a vertical and horizontal border, but is accompanied by a vertical zigzag of stretchers instead of a vertical line of headers.

In diagrams 22, 23 and 24 are shown varied treatments of unit II. Diagram 22, which is a modification of Flemish bond as seen in diagram 9, presents a wall surface composed entirely of these units completely dove-tailed. Here we have an excellent illustration of the distinction between bond units, as such, and pattern. The bond inevitably works out the bond units, and these may be of uniform color or texture throughout the wall; or, as here, brought out by color or texture treatment into distinct pattern units, which butt horizontally and are separated vertically by a header-

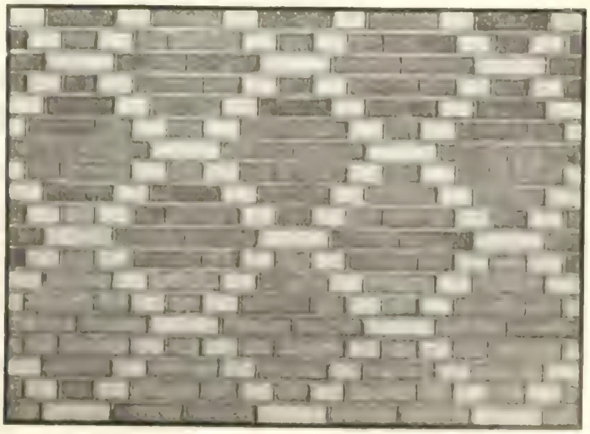

Diagram [illegible]

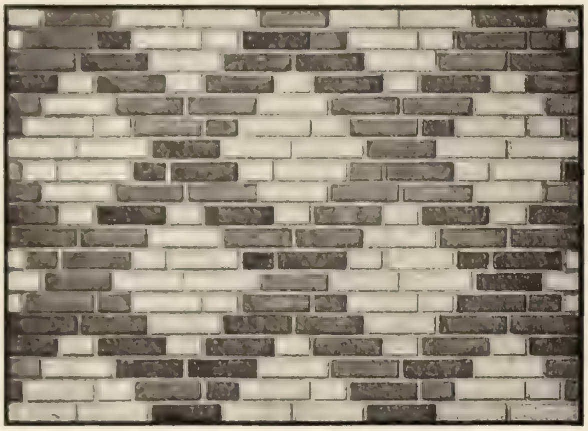

Diagram 28

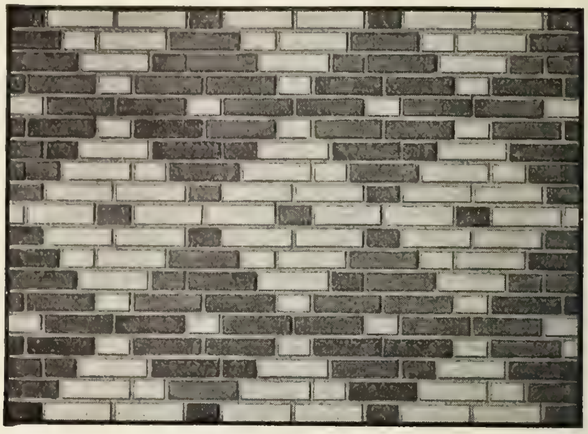

Diagram 29.

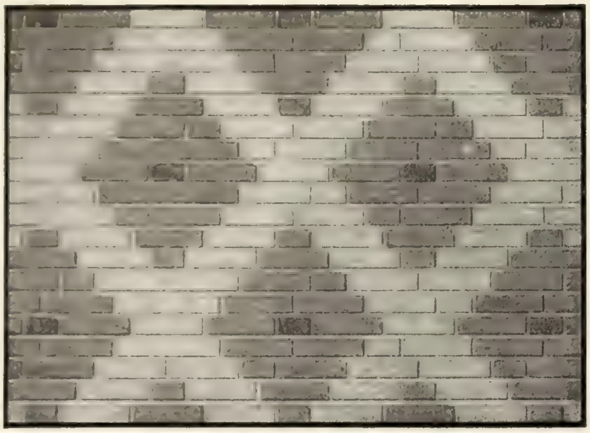

Diagram 30.

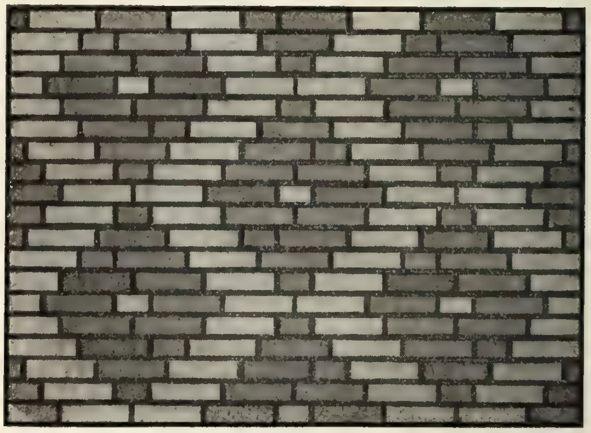

Diagram 31.

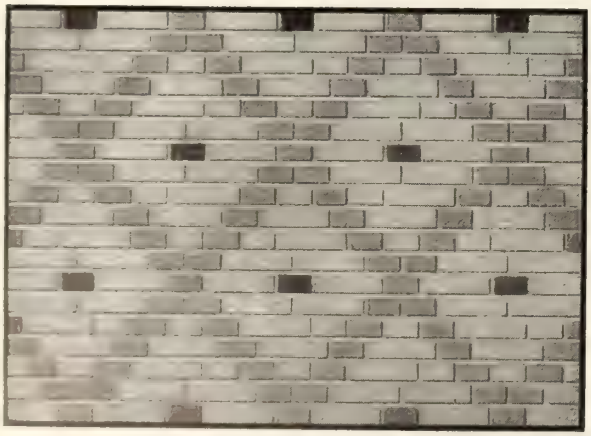

Diagram 32.

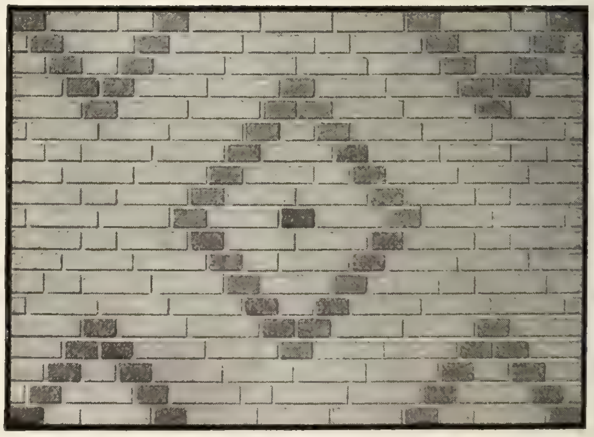

Diagram 33.

The Artistic Possibilities of Bonds and Mortars in Brickwork.

stretcher border. Diagram 23 is a garden wall bond with the units in vertical lines; while diagram 24 is a double-stretcher garden wall bond with the units in diagonal lines. In both there is a horizontal and vertical stretcher border about the units.

Diagrams 25, 26, 27 and 28 present a variety of design based on unit III. Diagram 25 shows a bond of stretcher courses, crossed, alternating with courses of two headers and a stretcher, in which the bond and pattern units have the same dovetailed arrangement as in diagram 22. Diagram 26 is the same bond as the preceding except that every sixth course is entirely of headers, flanked by uncrossed stretchers. Here, as before, the pattern units butt horizontally but, instead of lying vertically separated by a stretcher course, are set in dovetail fashion and separated vertically by a zigzag line of stretchers and headers.

Diagram 27 presents a very mixed bond in which Flemish and stretcher courses are intermingled regularly with courses of alternating stretchers and four-header groups. The units, deeply dovetailed, are separated horizontally by header and vertically by stretcher borders; and it is interesting to note that the stretcher courses are so set as to form the axial line of one horizontal row of units while serving as the horizontal borders of the next row of units. The pattern in diagram 28, worked on a bond of alternating Flemish courses and stretcher courses, crossed, shows the units separated by vertical and horizontal stretcher borders that sweep in great interlaced diagonal bands up and down the surface of the wall.

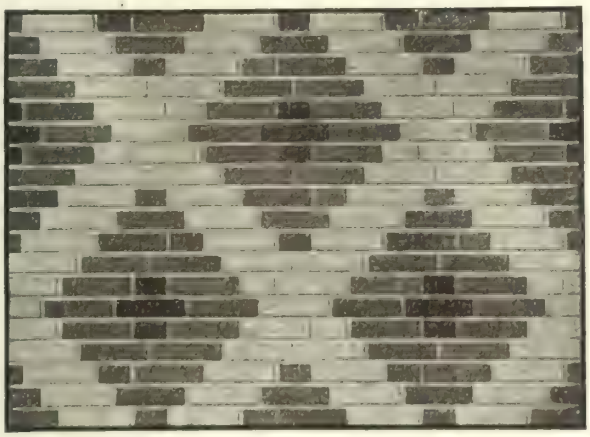

Diagram 34.

Nothing could show better than this diagram how really simple is the secret of working out these seemingly complex figures. Once having crossed the alternating stretcher courses, that is, shifted them half a brick each time, it is only a matter of attending to the method of shifting the Flemish courses by watching the movement of the header. Beginning for convenience with the fourth course, because in this diagram the first full unit begins there, it is seen that the header shifts its own width three times to the right and then three times to the left, and so on up the entire wall. It will also be seen that the headers rest alternately on stretchers and stretcher cross-joints, and that, with all the shifting, they never depart from this original position.

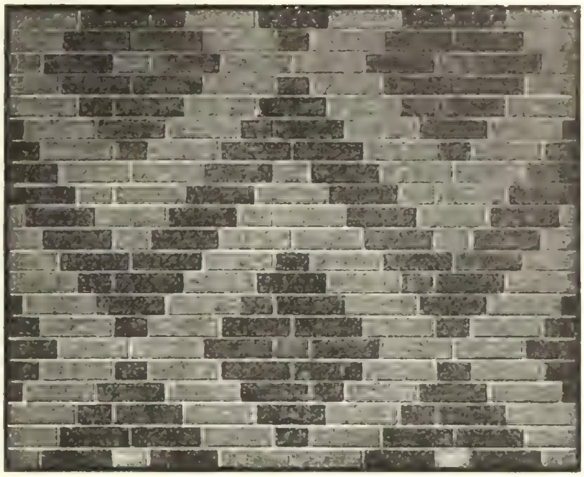

Diagram 35.

Digrams 29, 30, 31, 32 and 33 furnish beautiful examples of unit IV. Diagram 29 is a double-stretcher garden wall bond showing the same arrangement of units as in diagram 25. And yet aside from the difference in the size of the units employed, there is a striking difference in their appearance when viewed in their relation to the texture of the whole wall surface. In the first instance, the smaller units, with but one distinction of color, are woven together into a compact wall texture. In the second, the larger units, which would be too heavy if thus left solid masses of color, are enlivened by luminous points in their centers, the dark spots giving as much life to the light units as the light spots do to the dark units. Thus the wall is interlaced as a beautiful fabric and presents the appearance of lightness and vivacity.

Diagram 30 shows a garden wall bond with the unit set in dovetailed fashion but surrounded by a stretcher border.

Diagram 31, a four-stretcher garden wall bond, has the units more deeply dovetailed than they are in diagram 30, resulting in their being thrust apart horizontally by two stretchers instead of one. They also show a horizontal and vertical stretcher border, and are much enhanced in value by the bright spot in their centers. Diagram 32, a very mixed bond, shows the

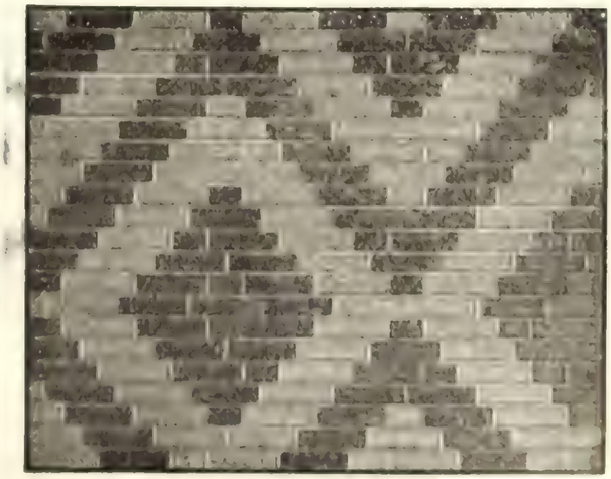

Diagram 36.

dovetailed units separated by header borders which form interlacing diagonal lines on the surface of the wall; while diagram 33, also a very mixed bond, presents in like manner the units surrounded by headers but widely separated by double-stretcher borders. By a little study, both the diagrams last named may be seen as presenting unit VI—merely outlined by the headers—enclosing unit IV. In the one case, the units overlap both vertically and horizontally; in the other, they stand out quite alone.

Diagram 34, a mixed bond, shows unit V. Here the units, holding in their centers Unit I, are set in exactly diagonal lines and bordered vertically and horizontally by stretchers; while diagram 35 presents a four-stretcher garden wall bond on which is designed unit VIII, containing unit IV, distinguished from each other by color tone. The dovetailed units are separated by a horizontally zigzag line of stretchers.

Diagram 36, on the left side, worked on a bond of alternating double-stretcher garden wall and stretcher courses, crossed, presents an appearance similar to that of diagram 35, but does so by the use of unit IX enclosing unit V, which in turn bears at its center unit I, all of them brought out by a difference in color. On the right side, by a change of bond, the contained unit V is made up of unit I surrounded by like units.

In leaving this subject, it may be well to observe that the choice of a bond unit and the way in which such bond units are to be distributed on the wall surface, as well as the manner of treating them in color or texture, are matters open to the widest divergence of individual tastes. One designer may be inclined to strong contrasts, while another may treat them with the utmost reserve. But in every case the one aim should be to weave the fabric of the wall in such a way as to make evident its fitness both to the nature of the structure and to its surroundings, natural and artificial.

The subject of bond, however, can hardly be dismissed without a word, and a diagram or two, on paving or panelling bonds. They may be illustrated in a few typical forms.

Diagrams A and B show a herring-bone pattern which may be laid with the brick flat or on edge. Diagrams C and D represent a basket pattern in its two forms, that is, laid flat or on edge. Diagram E is a basket pattern laid flat separated by borders laid on edge; while diagram F shows a basket pattern laid on the edge separated by borders on the flat.

A Suggestion

These bonds and patterns here illustrated are meant to serve as helpful suggestions to the designer in brickwork; his ingenuity and taste may lead to any number of possibilities along the same line. While the methods of bonding, when once a bond is chosen, are strictly governed by mechanical rules, the pattern schemes, a few of which have been presented here, are a matter for the individual taste of the architect or the prospective builder. These diagrams are by no means intended to dictate what may or may not be the true

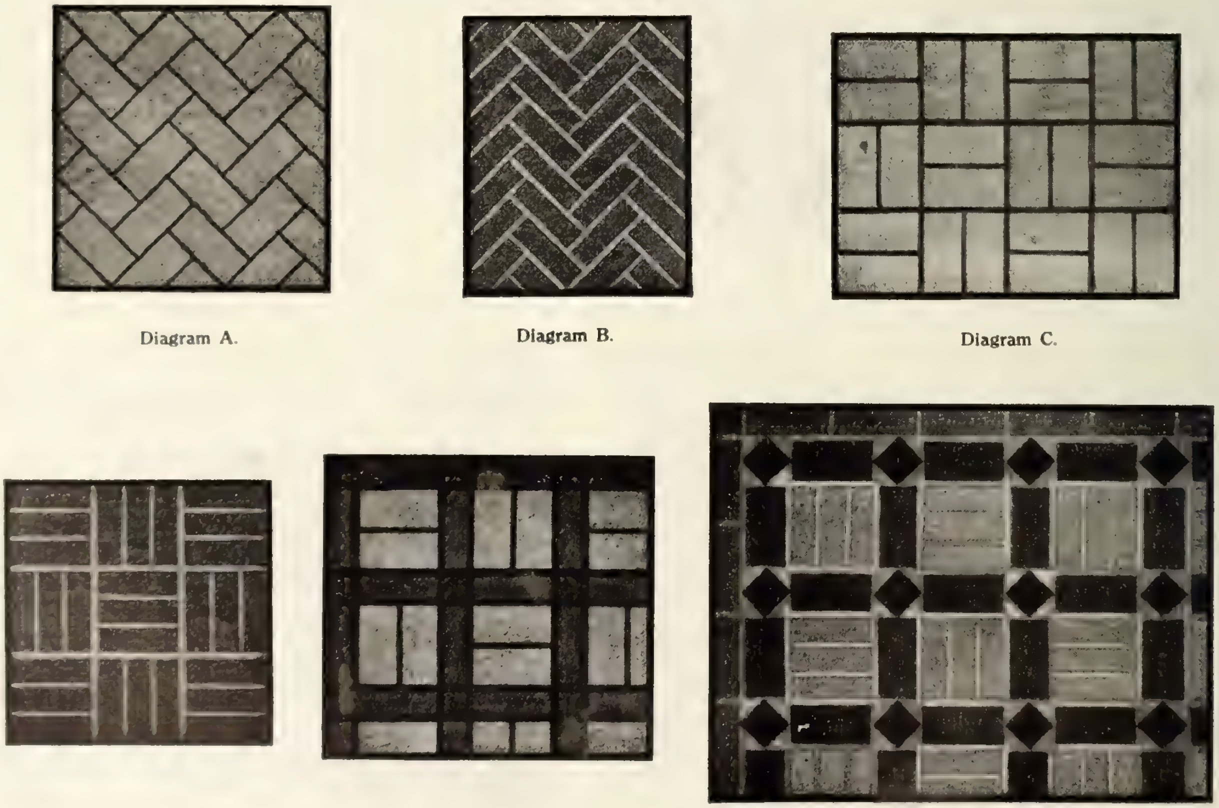

Diagram A.

Diagram B.

Diagram C.

Diagram D.

Diagram E.

Diagram F.

The Artistic Possibilities in Bonds and Mortar Brickwork values of color tones in any given bond, what the blendings of light and shade or the contrasts of color and texture in brickwork, but merely as suggestive hints for pattern design.

At the same time, an underlying principle is involved in what has been thus suggestively presented. It will be readily understood that the smaller units, which are worked into patterns of finer texture and quieter shadings, are more appropriate for wall expanses of limited area, while the bolder outlines and heightened contrasts of the larger figures are more suitable for large sweeping wall surfaces.

(The concluding portion of this article—Part II—will be published in our next issue.)

A Symposium on Heating and Ventilation and Some Mechanical Errors of Installation

By Thomas Morrine, M.E.

THERE is, perhaps, no branch of engineering which comes within the scope of the architect's responsibilities that has been so much abused, hampered and trifled with as that of heating in its various forms of radiation, ventilation and domestic hot water; at the same time there is none that is so simple and assured of satisfactory results as this particular portion of a structure when properly designed and installed. There is absolutely no mystery, superstition or difficulty about the whole problem if one would consider for a moment the natural laws of gravity and the effect of heat.

Heat or heat losses are the cause of action in all heat radiating apparatus, be the medium steam, water or air. If this heat action is combated or thwarted by an apparatus that is designed contrary to, or preventing the natural effect of the laws of gravitation, without the assistance of some mechanical device to overcome this defect, there will be trouble, and unsatisfactory results will occur.

You will hear people, who are not correctly informed in these principles, talk of forcing the circulation of hot water or air in this way or that way; such remarks, belief and suggestions are ridiculously wrong. There is no such thing as forcing the circulation of any of these elements, in any direction, in a piping system that is arranged contrary to the laws of gravity unless, as I said before, it is assisted by some mechanical device in the way of a pump, fan, air, steam or water blast, or similar arrangement that will have to be maintained by power, especially brought in or connected for the purpose.

As steam at low pressure is the most common agent, and as direct radiating systems are the most popular for heating purposes, we will take that branch up first as a matter of discussion.

Steam at low pressure requires piping of a large size (not steam tables) and so arranged that the condensed water and steam may travel in the same direction, as far as possible and practical, and the mains so arranged that they will be comparatively dry at all times, and of such dimensions that the difference in pressure between the source of supply and the point of return will be so small that a water head of a few inches will overcome it; that is, this condition is absolutely necessary for a successful gravity return system such as is commonly used in dwellings, apartments, small hotels and kindred buildings that do not have a complete steam power plant using high pressure steam.

The velocities through the mains should not exceed 20 feet, and at the outside 25 feet per second for the steam, and for water a maximum of 6 to 8 feet per second will give satisfactory results. If these conditions are changed and the velocities increased by the use of smaller pipes, you may expect trouble, and the trouble will be with you as long as you live. There is no escaping the result in a conflict with the law of gravity, no more than there is in a conflict with other laws of nature. New discoveries are being made every day, new schemes devised, new apparatus invented, promoted and foisted upon the people as a cure-all and the last word in all these troubles. If you purchase the arrangement you are assured that you will be forever freed from the annoyances of a noisy heating system and the constant nagging of dissatisfied clients because of the unsatisfactory condition of the piping.

By adopting some of these modern mechanical schemes of improved valves, etc., some relief may result, and it often does, but not any more from the adoption of the improved apparatus than from the opportunity this change affords a good practical heating engineer or steam fitter to change the system in general, so that results would very often be as satisfactory without the improvement as with it; but such opportunity would never have occurred had not the change been imposed by the placing of the improved apparatus that receives a credit to which it only is indirectly entitled. So much for steam.

In the matter of hot water for radiation or for a domestic hot water sanitary service, the circulation is usually controlled by the difference of density due to the heat infused into the water by conduction, convection or radiation. The source of heat matters little as long as the temperatures are acquired. The circulation through a system, unless accelerated by mechanical means, depends entirely upon the law of gravitation, and the velocity of motion is determined by the law of falling bodies, counteracted by the friction in the piping, bends, valves, angles, etc.

Now, it may surprise some of you to know that the small difference by expansion between the heights of a column of water at, we will say, 180 degrees and at 160 degrees Fahrenheit, a difference of 20 degrees, is the sole and only influence that causes hot water to circulate in a gravity system. You will realize, therefore, the importance of having the piping of such a size and arranged in such a manner as to minimize the resistance to the flow of water under these influences so that you may reap the full benefit of the coal or other fuel used for generating the heat.

Heating systems and the distribution of steam and hot water for heating purposes in general have so far escaped the rigid rules laid down by the local law-makers for sanitary systems, because the failure of the former does not so materially affect the public health as does the latter, but I have often felt that it would be wise on the part of the communities, as a protection to the owner and to the renting population, to prescribe that established rules for the placing of a heating apparatus should be as carefully protected by a simple law as are the sanitary rules that we are now working under.

When a faulty system is once installed and the building enclosed and finished, it is a hard problem to change or to rectify the defects without a serious disturbance to the structure and occupants of the building, and a great additional cost to the owner. These difficulties have brought about a serious state of affairs since the institution of street service, as I know from personal experience, having been called in on several occasions to rectify these difficulties, that, in the imagination of the owner, are brought about by connecting steam with the street; and while the street service has its shortcomings, yet it often is unjustly condemned because of inherent defects in the heating systems and in the general arrangement of the plant before the street connections are made. These annoyances have been the cause of a great deal of dissatisfaction and bickering between the street service corporations and the property owners in many instances.

Architects, as a rule, are prone to conceal piping, very often to the detriment of the system, not that it is necessary to expose piping if sufficient space is allowed for the pipe and the necessary insulation to prevent unnecessary radiation and comply with the underwriters' rules.

Again, others are not satisfied unless a forest of pipes and risers are installed in a system, for no useful purpose whatever, except of causing an excessive fuel consumption and corresponding overhead loss to the owner for all time. They seem to lose sight of the fact that these conditions remain forever, that there is absolutely no relief except a complete remodelling of the whole system, which very often is next to impossible.

The distribution of air in buildings, particularly in wooden structures, brings about, as a rule, a warm contest between the architect and the engineer, because of the difference between the size of ducts necessary for efficient service, and the size existing in the imagination of people who do not go into the merits of the system in the proper form or frame of mind. An architect would not think of reducing the size of a sanitary main or of a water pipe for a certain specified service, yet he will wrangle with you for an hour to get a few inches off a hot-air duct or spread it out in pancake form, which makes it next to impossible to get any air through it at all, to say nothing of the generous volume that is actually required for a satisfactory ventilation or indirect heating.

It is a well-known fact that a square chimney is only useful to the extent of the largest circle that may be inscribed within the square; the corners are useless owing to the excess friction, but the peculiar condition of our construction of brick and mortar, the square or rectangular chimney is more conveniently constructed and conforms better to architectural lines than the circle where the chimney is built into the wall and made part of the structure; yet we are compelled sometimes to make ventilating ducts of a square or rectangular form that increases the skin friction to such an extent that, although of the same sectional area, they are practically useless for chimneys or air ducts, and the purpose for which they are originally intended is completely lost sight of or destroyed.

If it is necessary to pass 1,500 cubic feet of air through a duct per minute at a velocity of not to exceed 1,500 feet (which should be the maximum for any air circulating scheme), that duct should be circular and of one square foot in area or square, or perhaps rectangular, but the least width should never be less than two-thirds the side of the square necessary for the area required, because as soon as you begin to increase the width and diminish the depth you are increasing the skin friction of the duct to an injurious and sometimes prohibitive extent. Who has not seen an 8-inch diameter duct flattened out and squeezed into a 2½-inch thick by 22-inch space in a framed partition, and the contractor condemned because he could not deliver the maximum amount of heat and air through the register connected to a duct distorted in this manner?

I am not calling your attention to these facts in a spirit of fault-finding or of egotism on the part of the engineer; I am simply mentioning them to expose an objectionable and ill-founded practice, and to emphasize the point that in the correct make up of a building the heating and ventilating portion of the equipment stands on a par in importance with its other details.

The Value of Cost Data in Highway Engineering

By Major W. W. Crosby[*]

THE mention of cost in connection with any discussion of highway work seems almost inevitable, and its analysis or even its statement always arouses interest and, frequently, discussion. Cost is the ready yardstick of the world for measuring the worth of many things, including the results of road and street work. Often it is not the only one that can and should be used, but, generally speaking, it is the one most frequently applied. The importance of its standardization may hence be readily inferred. In the engineering prescription toward a result, almost the first question after the possibilities of the solution of the problems have been indicated is, "What will it cost?" If variety in the solution is practicable, a comparison of the costs becomes necessary in order to assist if not to determine the wise choice. The recording and compilation of cost figures regarding work in progress is the most practical way, in these days of enormous operations, for testing the efficiency of the organization and individuals employed thereon, and for enabling the proper management of the work. In small operations, where the details are not beyond the capacity of the individual in charge, personal knowledge and ability might be successfully depended upon to produce economical results and proper work; but as soon as the operation grows in size beyond the capacity of the individual in charge to control the details, inefficiency is bound to result unless proper records of cost are promptly presented.

The desiderata for cost data may be said to be comprehensiveness, clearness, conciseness, low expense of keeping, ease of keeping by unskilled employees, readiness of and clearness in compilations, regularity of compilation, and periodicity of publication.

Of course, if vouchers containing sufficient detail concerning each expenditure are preserved and filed, it may be said that cost data is being accumulated in a way, but few will pretend that such a course is sufficient. However, every record of expenditure should be so comprehensive on its face as fully to explain the payment made. Clearness should mean intelligibility without the aid of personal explanation from the responsible party in the case of a voucher, and, in the case of accounts, the reasons for segregation of different vouchers into one or more accounts should always be clearly logical or apparent from the established rules provided.

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[*] Chief Engineer, Maryland Geological and Economic Survey.

It may be said, without fear of contradiction, that the large majority of costs yet published, either of details of road work or of organizations for road work, are of no scientific value, nor are they of any appreciable value, except to members of the respective organizations themselves, and no fair comparisons between the work of different organizations, such as the various state highway departments, are possible in spite of the voluminous publications available.

It will be readily seen that if several states or organizations engaged in similar work kept and published their expenses along similar lines it would easily be possible to compare the relative efficiency of each, even though many local conditions were dissimilar, and allowance had to be made therefor. A type of organization could thus be tested. Types of construction could be proved. Even corruption or inefficiency could be detected, and real defects of materials or methods could be observed. With all these advantages would also come that of presenting to the taxpayers, in understandable form, a concise report as to the expenditure from the public funds so that criticism could be made effective when good, and disarmed when merely captious, unreasonable, or malicious.

In establishing any system for recording and compiling cost data, while the outline may proceed from the top down, the actual work must be begun at the bottom and proceed upward. Hence consideration of the foundation in this matter, as in all highway work, is necessary. No system can be successful which relies on an impractical foundation—that is, the compilations and accounts must be settled with a clear view as to the possibility of obtaining the data on which they are to rest. For instance, unless expert timekeepers are to be employed regularly, it is useless to provide too much sub-division of accounts. In ordinary maintenance work by a patrol-man all that can be expected on this line from the patrol-men best fitted for the physical work is that they will be able to report separately the expense for earthwork culverts (including shoulders), bridges and drains and surfacing, with occasional special reports, from a special inspector perhaps, of such special work as the painting of the edges of the surfacing or the taking up and relaying of a pipe. It may even turn out to be impracticable for the maintenance work to be separated between two differently contracted-for sections of the same road.

Further, in proceeding upward from the collection of facts regarding costs toward the final compilation, the accounting and the intermediate compilations should be so arranged as to fit progressively into the final scheme without the necessity for retracing at any time the steps taken up to that point.

It is true, as first stated, that "cost" is not the only measure of value of work done, though it is a very common one. But other criteria should not be neglected or allowed to slip into "innocuous desuetude." Engineers have been criticised as lacking breadth, and as being too materialistic. It behoves us, therefore, to keep our eyes open to the criteria other than "first cost," or even "long-run cost," in passing judgment on work done, important as the cost factor may seem to be.

Interesting Application of Cableways at Grand Mere

An interesting application of cableways for both excavation and construction is shown in the illustration of the work now under way at Grand Mere, Que., for the Laurentide Company. This project, including the dam and power house, involves the placing of 175,000 cubic yards of concrete and 110,000 cubic yards of solid rock excavation. Work began early in 1913. The cableways were erected at the beginning of the summer and good progress was made all winter, notwithstanding the severity of the weather.

The illustration shows at the right hand side of one channel of the St. Maurice River the rock and sand storage and the concrete mixing plant. At the middle of the picture is shown the island with Grand Mere rock in the foreground. The entire top of the island, which is of solid rock, with a thin overburden, will be removed in order to give sufficient spillway, and this rock is carried across the river and channel to the rock storage pile at the right. The new power house will be located at the left of the picture, changing the present mill structure, and the view shows this channel of the river unwatered by means of the cofferdam below and above proposed site of the new power house. Already a large amount of rock has been removed from the island and considerable concrete laid for the power house foundation and draft tubes.

Three Lidgerwood cableways are employed, the

Lidgerwood cableways at Grand Mere, Que.

long span being 1,653 feet, with towers at the extreme ends of the picture. This cableway takes mixed concrete to the site of the dam and power house. The intermediate span, 1,118 feet, takes rock from the island to the crusher and storage pile. The short span, 613 feet, is used for taking rock, sand and cement to the small auxiliary crusher plant on top of the present mill building from which mixer plant the concrete is discharged directly into the power house foundations and walls.

There will be a fourth cableway, 5-ton capacity, 900 ft. span, used for constructing a section of the dam to be located to the right of the picture and which will be a separate unit of construction.

The two long span cableways are each equipped with the latest Lidgerwood improved aerial dump adapted for discharging automatically at the will of the engineer, either skips or bottom dump concrete tubs, the skips being so discharged into the crusher or storage pile.

The longer span cableway taking concrete and conveying it a distance of 1,100 feet from the mixer handled 387 cubic yards in ten hours in two-yard batches. The bottom dump tubs are discharged automatically at any point along the span, going in either direction and at any elevation, either raising or lowering entirely under the control of the operator. The record mentioned was made at a distance of 1,100 feet from the hoist and operator. The concrete is placed directly into forms or deposited into hopper from which it is spouted.

Messrs. Canadian Allis-Chalmers, Limited, are exclusive agents in Canada for Lidgerwood Cableways.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The Bowlby Sand Lime Brick Company, Limited, Milton, Ont., capitalized at $100,000, has obtained a charter.

A new central police station, estimated to cost $350,000, will be erected in Toronto, following a recent decision of the Board of Control.

Mr. R. A. Pringle, K.C., of Ottawa, has arrived at St. John, N.B., to conduct a government enquiry into the cost of the Southampton Railway.

A new building by-law is at present before the City Council of Sherbrooke, Que., providing for the creation of a Building Inspector's department.

A Fort William contracting firm, Messrs. Flanagan & Murphy, have secured the contract for the laying of water and sewer mains in Humboldt, Sask. The contract price is in the neighborhood of $100,000.

Work is in progress on the customs house which the Dominion government is erecting at Ottawa at a cost of $400,000. The concrete work on piers for foundations has been completed. The building will be five storeys high.

Announcing the taking over of the Kingston Shipbuilding Company, of London, Eng., a recent despatch from Kingston states that the company is considering the establishment of another branch of its shipbuilding activities at Fort William.

At Port Arthur, Ont., operations are to commence on the construction of a new breakwater estimated to cost $475,000. The work is to be done for the Dominion government by the Port Arthur Construction Company, Limited, whose manager is Mr. J. C. Hicks.

A number of the directors of Standard Clay Products, Limited, left Montreal last week on a visit to the firm's large new plant just completed at New Glasgow, N.S. Arrangements are being made for the rebuilding of the company's No. 2 plant which was destroyed by fire recently.

The great majority of the building permits now being issued in Montreal are for residences, there being comparatively few large buildings in course of erection. As showing the tendency, one day recently 43 permits, of the value of $250,000 were issued for residences, this being the largest number issued during any day.

It is now practically assured that the programme of Fort William's civic improvements for 1914 totalling some half million dollars, will be carried out and completed this year. The improvements are for paving and road building, and for the extension of the street railway to the industrial zones on the Islands and other outlying localities.

The Lake Superior Ship Building & Dry Dock Company has applied for an extension of time in which to commence construction of the new dry dock which is to be built at Sault Ste. Marie, Ont., at a cost of a million and a half dollars. The delay in completing the plans was caused mainly by necessary legislation.

Consequent upon a dispute with the Montreal Light, Heat & Power Company as to the annual cost of lighting certain streets from underground distribution, the civic superintendent of lighting has reported on a plan for installing a power plant for the central district. This, he estimates, will cost $172,667, with annual operating expenses of $54,100.

At St. John, N.B., work is in progress on a bridge across the Reversing Falls. The general contractors are Jos. McVey & Son, St. Stephen, N.B., and the estimated cost of the work is $325,000. Work on the superstructure will start shortly. The bridge will be 565 ft. long. It is being erected for the provincial government of New Brunswick.

Railway construction continues active in New Brunswick. In addition to the Valley Railway work has been started on the new line which is to run from Plaster Rock to Riley Brook, a distance of 28 miles, and later is to be extended to connect with the I. C. R. about half way between St. Leonard's and Campbellton, on the north shore of the Province. Four lumber milling companies have already consented to erect mills along this new line.

In addition to the big harbor improvement contract awarded the Thunder Bay Contracting Company for a sea wall at Fort William, Ont., costing $340,000, the dredging operations which were started a few days ago will equal, if not exceed, last season's expenditure, which was over $1,200,000. Five huge dredges are at work in the Kaministiquia, McKellar and Mission rivers, and three more will be added in a week or two. Fifteen or twenty tugs and thirty mud scows are employed in attending to the dredges, and a force of some 300 men are busily engaged on the work.

WESTERN CANADA

The power and development committee of Calgary has recommended that the Engineering Department of that city proceed at once to make test borings at dam site No. 4 on the Elbow River, with a view to determining whether the rock foundations and side walls are sufficient to carry it down. The cost of such borings is estimated to approach $10,000.

The Regina Red Press Brick Company has located in the Saskatchewan capital, and a plant is being erected at a cost of $75,000.

Contracts will be placed immediately for buildings estimated to cost $300,000 for the Saskatchewan Provincial University, of Saskatoon.

The ratepayers of Regina have approved a by-law providing for a site on the north side of the city for the erection of a Collegiate Institute.

The Calgary waterworks are to be extended at a cost of $250,000. The engineer in charge is Mr. A. W. Fawkes and the city clerk, Mr. J. M. Miller.

At Dauntless, Alta., operations are about to be commenced on the erection of a factory estimated to cost $750,000 for the Dominion Harvester Company.

Mr. J. A. Browne, of the Bogue and Brown Lumber Company, is erecting a four-storey hotel, 120 by 110 feet, estimated to cost $125,000, at Edmonton.

The city commissioners of Regina have invited tenders for the supplying of about 150,000 ft. of sewer pipe, ranging from 6-in. to 60-in., also for 400,000 sewer bricks.

The Winnipeg Public School Board are having plans prepared for a $200,000 shool building at the corner of Helen and Fleet Streets. The architect is Mr. J. B. Mitchell.

The Canada Cement Company expect to have their new plant at Dauntless, Alta., completed in time to supply the demand for cement which will coincide with a renewal of active building operations.

Preliminary sketches have been prepared for a new school building at Vancouver, B.C., estimated to cost $100,000. The plans are by the Superintendent of Construction for the School Board, Mr. Giles.

At Edmonton, Alta., an eight-storey addition is to be made to the Y. M. C. A. building at an estimated outlay of $500,000. Plans for the new structure are being made by Messrs. Magoon and Macdonald.

It is announced that excavation has been completed and that construction will begin soon on a seven-storey office building at Edmonton at a cost of $120,000. Messrs. Cauchon and Van Tyne have prepared the plans.

Richardson Builders, Limited, of Saskatoon, Sask., have secured the contract for the construction of a students' residence at the University of Saskatchewan, Saskatoon. The amount of the contract is about $200,000.

Messrs. Frid Lewis & Company, of Regina, are the contractors for a new police station to be erected in that city at a cost of nearly $150,000. The building will be four storeys high, of brick and reinforced concrete construction.

The Edmonton School Board has just authorized an issue of $850,000 of forty year debentures at five per cent. Most of the money will be expended on buildings, the balance for improvement of real estate and equipment of schools.

Three hundred and eighteen permits for buildings, estimated to cost $750,922, were issued in Edmonton during April. Four hundred and seventeen permits, involving $2,080,380, were issued during the same month last year.

Preliminary contracts in connection with the Royal Jubilee hospital at Victoria, B.C., are now being awarded. The estimated cost of the building is $400,000. The architect is Mr. L. P. Rixford, of Victoria and San Francisco.

Announcement is made that the Confederate Securities Company, recently incorporated with a capital of $250,000, will erect a four-storey office building, costing $90,000, in Edmonton this year. The structure will be 66 by 128 feet.

At Regina, nine tenders were received for the erection of a ladies' residence and towers at Regina College. The successful contractors are Messrs. R. J. Lecky & Company, Regina, whose tender for the entire work amounted to $147,800.

Mr. Albert W. Coate, manager of the Wallace Sandstone Quarry, Limited, expressed the opinion at Regina recently that the raising of the tariff on the finished product would not result in any increased cost on building stone to Canadian contractors.

Sand & Gravel Deposits, Limited, is the name of the latest Saskatoon company to have been incorporated a joint stock company. Mr. A. C. McKeown is president of the company which is capitalized at $100,000. The head office is in Saskatoon.

The contract for the extension of the water and sewer system at Swift Current, Sask., has been let to Mr. S. Holmes, a Regina contractor, at $40,000. Mr. Thos. Barnard has secured the contract for erecting the Rose theatre at Regina, at a similar amount.

Calgary contractors have petitioned the Dominion government to call for separate tenders for the new post office which is to be erected in that city at a cost of $1,000,000. The building is to be six storeys high. It will be faced with marble and granite.

The city of Edmonton will probably submit a bylaw to raise $175,000 for the construction of a filtration plant with a capacity of five million gallons. The amount was passed last year, but the bylaw may have to be submitted again to comply with a legal formality.

At Saskatoon, the erection of the stores and offices on Third Avenue for J. C. Drinkle is well advanced. The building will be ten storeys high, of brick, stone and reinforced concrete construction, and will cost $600,000. The architects are Messrs. Thompson & Crockart, of Saskatoon.

Constructional activity is increasing in Regina, Sask., and many large building and engineering undertakings have already been started. It is proposed to erect a 5,000,000 gal. rectangular reservoir on the site of the old power house. The dimensions are 250 feet by 155 feet with a depth of 23 feet

The provincial government of B. C. has invited tenders for the proposed steel and concrete bridge across the Pitt River, on the Dewdney trunk road, at an estimated cost of $700,000. The tenders are to be in the hands of the Hon. Thos. Taylor, Minister of Public Works, by noon on May 26

The Moose Jaw ratepayers have approved of a by-law to raise $301,000 for sewerage and waterworks, details of which are as follows: completion of Sandy Creek waterworks, $[illegible]000; sewage disposal plant, $30,000; completion of subway, $28,000; storm sewers, $115,000; sanitary sewers, $43,350;

bridge Eighth Ave., $30,000; high pressure waterworks system, $30,000.

A new 12-in. main, providing an additional supply of approximately 1,000,000 gallons a day, has been completed at Victoria, B.C. This brings the total daily supply available from the Esquimalt Waterworks Company to 56,000,000 gallons. By next fall the pipe lines of the Sooke system will be laid from Victoria to a point beyond Parson's Bridge, so that a permanent connection with the system of the Esquimalt Waterworks Company will be made.

Good progress is being made on the construction of the new bank and office building which is being erected on Portage Avenue, Winnipeg, for the Quebec Bank, by Messrs. Carter Halls Aldinger. The building is 108 ft. by 62 ft. in dimensions and is of brick and reinforced concrete construction. There will be four storeys with basement. The estimated cost is $225,000. Messrs. Brown & Vallance, of Montreal and Winnipeg, are the architects.

At Edmonton, Alta., an Armory building is to be erected for the Federal government at a cost of $280,000. The permit was issued on May 8, and work will begin at once. The building will have a frontage of 174 feet and a depth of 240 feet. It will be of brick with concrete foundation and steel superstructure. The plans were prepared by Messrs. D. E. Ewart and E. C. Hopkins, the contractors being the C. Lyall and Sons Construction Company, Limited.

Work on the first of the buildings for the Provincial University at Point Grey, B.C., is to be commenced this summer, the plans for the Science Building being completed by the architects, Messrs. Sharpe & Thompson. The west facade of the building is 250 feet long and averages about 55 feet in depth. With the various buildings around it the structure will eventually take the shape of a quadrangle. The elevations are to be constructed of Brandon stone of a brown or buff color, taken from the British Columbia quarries, while the facing around the windows and other relief work will be of dressed stone. The design is a modern adaptation of the Tudor style of architecture.

Construction on the Saskatchewan tuberculosis sanitarium at Fort Qu'Appelle, near Regina, has been resumed, and the contractors to date are as follows:—Parsons Construction Company, construction of buildings, $118,100; Connor Bros., Winnipeg, heating and plumbing, $27,855; North West Electric Company, Regina, engines, generators, switchboard, mechanical and electrical supplies, $11,112; Canadian Kellogg Company, Winnipeg, radial brick smoke chimney, $3,415; Stewart Machine Company, Winnipeg, laundry machinery, $3,850; Mr. Geo. E. Siebert, Winnipeg, refrigerator plant, $4,397; Mr. O. M. Smith, Winnipeg, water reservoir and pipe line, sewage disposal plant and sewers, $17,507.

Canadian Railroad Development

The Intercolonial Railway is installing the single-mile block signal system on its roads between Moncton, N.B., and Painsec Junction.

The Dominion Government has signified its approval of a bill to incorporate the Rainy River Radial Railway, which seeks authority to operate south to two points on the International boundary.

Two million dollars, at the rate of $300,000 a month, will be expended this year by Mr. J. D. McArthur, builder of the Edmonton, Dunvegan & British Columbia, and the Alberta & Great Waterways railroads, according to official announcements made in Edmonton on May 8. Seven hundred thousand ties have been cut and steel for 230 miles of line is on hand.

Personal Mention

Mr. Paul Mercier has been appointed Assistant City Engineer of Montreal at a salary of $5,000 a year.

Mr. C. C. Mendham has been appointed resident engineer in Berlin, Ont., for the Herbert Morris Crane and Hoist Company, Limited, Toronto.

Mr. Walter Lyon has been appointed the Montreal representative of the Standard Ideal Company, Limited. Prior to this Mr. Lyon was with the Standard Sanitary Company, Toronto.

Mr. William McNab, Principal Assistant Engineer of the Grand Trunk Railway, has been elected President of the Canadian Railway Club. He is a member of the Canadian Society of Civil Engineers and of kindred societies. Mr. R. M. Hannaford, Assistant Chief Engineer of the Montreal Tramways Company, is the Second Vice-President of the Railway Club, and Mr. James Powell, Chief Draughtsman of the Grand Trunk Railway, is Secretary.

Mr. R. S. Lea, of Montreal, has been appointed consulting engineer of Fort Garry, the municipality adjoining the city of Winnipeg to the south. Mr. Lea will advise the town in regard to the installation of new water and sewerage systems.

Mr. R. W. Burnett, master car builder, C. P. R., has been presented with a past president's medal of the Canadian Railway Club on retiring from the position of president. Mr. J. Hendry, master car builder, G. T. R., and Mr. G. Smart, master car builder, I. C. R., Moncton, have been elected members of the executive committee of the club.

Mr. Wm. Wainwright, Sr., vice-president of the G. T. R. and G. T. P. railways, died last week. He was born at Manchester, Eng., in 1840 and entered the service of the Grand Trunk Railway at the age of 22 a senior clerk to the chief accountant at Montreal. He rose rapidly and after filling the positions of general passenger agent, assistant manager and assistant general manager, he became, in 1896, general manager of the entire system. His appointment as vice-president was made within recent years.

The all-steel passenger car which the C. P. R. has adopted, has several original features, one of these being the roof which has been designed on the "modified turtle back" type, and is said to give the maximum of light and ventilation. The car is ten feet wide, eighty-two feet long, seats eighty-four persons and weighs 114,800 pounds. It is estimated that the cost of replacing the wooden cars on all the lines, with all-steel coaches, would cost approximately six hundred million dollars.

In New Brunswick generally, constructional operations are proceeding briskly. Railway enterprises are being pushed along as quickly as possible. In St. John, the harbor works are being pushed, but there is a feeling that the progress is not as fast as it should be, or as fast as the circumstances demand. No doubt during the coming season this very important scheme of port development will be taken up with more determination as a great deal is depending upon it. Building enterprises throughout the provinces are very active. This is particularly the case in St. John, where several large buildings are in progress of construction and where the housing problem is being met by the erection of a number of residences in attractive localities.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherst, N.S.

The town council is about to call for new tenders for the laying of bitulithic and macadam pavements and concrete sidewalks on 4 streets.

Calgary, Alta.

The by-law providing for improvements to the parks at a cost of $50,000, has been defeated by the ratepayers.

Tenders will be received by the city council until May 26th, for the supply of waterworks valves, a cheque for 3 per cent. of the amount of the tenders is required. Specifications are with the superintendent of waterworks, W. E. Fawkes.

Chatham, Ont.

Plans are being drawn for the construction of 5 miles of cement sidewalks on various streets.

Edmonds, B.C.

Tenders will be received by the municipal clerk, A. G. Moore, until noon June 1st, for the supply of about 10 miles lapwelded steel water pipe. Specifications, etc., are at the engineer's department, Municipal Hall.

Hull, Que.

The laying of a sewer on Adelaide St. is being considered by the city council.

Lindsay, Ont.

Tenders for the construction of sewer pipe and cement sewers on Victoria Avenue are invited by the town council. The engineer in charge is Mr. A. Williams.

Montreal, Que., St. Lambert

Tenders will be received by the town council until 6 p.m. May 26th, for the installation of storm and sanitary sewers, street gulleys and manholes. Plans, etc., are at the office of the town engineer, E. Drinkwater.

Moose Jaw, Sask.

Permission has been granted by the Provincial Government to raise the sum of $30,000 for the construction of water mains and sewers in River and Wellesley Parks.

A by-law involving an expenditure of $301,000 for the installation of sewers, waterworks, etc., has been carried by the city council. The work includes:—the completion of Sandy Creek waterworks, $25,000; sewage disposal plant, $30,000; the completion of the subway, $28,000; storm sewers, $115,000; sanitary sewers, $43,350; 8th Ave. bridge, $30,000; and a high pressure waterworks system, $30,000.

Orillia, Ont.

Plans are about completed for the remodelling of the waterworks system, at a cost of $50,000. The plans are to be approved by the Provincial Government, and a by-law may be submitted to raise the necessary funds. The system is to be remodelled by the installation of 8 or 10 filters, a Diesel engine, turbine pumps, valves, etc. W. K. Greenwood, West St., is the engineer.

Ottawa, Ont.

Plans have been drawn for the construction of asphalt pavement on Nicholas St., between Laurier and Mann Sts., at a cost of $36,000, and on Mann Avenue between Nicholas St. and Hurdmans Rd., at a cost of $6,590.

Province of Saskatchewan

The Board of Highway Commissioners will receive tenders until May 30th for the construction of a drain in township 27, Range 4 West 2nd Meridan, 15,984 cu. yds. of earth to be moved, also for the construction of a drain through sections 27, 22, 15 and 10, township 33, Range 10, West 2nd Meridan, 25,176 cu. yds. earth to be moved. Specifications, etc., are at the office of the chairman. Engineer, F. J. Robinson, Parliament Buildings, Regina.

Russell, Man.

Tenders will be received by the secretary-treasurer of the rural municipality of Russell, until June 10th, for between 6,000 and 7,000 cu. yds. of excavations and embankments, 115 rods of road grader work and a 22-ft. pile culvert. Plans and specifications are at the municipal office or will be mailed to contractors upon application.

Streetsville, Ont.

Tenders will be received by the village council until May 23rd, for the supply of the necessary material and labor for the construction of 4,570 ft. of concrete walks.

Toronto, Ont.

Tenders for the construction of sewer in connection with Moore Park Drainage Eastern Section close with the Chairman of the Board of Control, May 26th.

The Etobicoke township council propose to construct a brick road on a cement foundation to run from the lake [illegible] bank of the Humber River. The estimated cost is $50,000.

Tenders close with the Board of Control on May 26th for excavation, laying, jointing of [illegible] iron water pipes and valves and special castings. Plans are at [illegible] Water Works Department, City Hall.

Toronto, Ont. (Islington)

The Etobicoke township council is considering the laying of three miles of roadway from Islington to Burnhamthorpe, to be [illegible].

Watford, Ont.

A report on the proposed extensions to the waterworks system is now being considered by the town council. The installation of a fire pump and engines, a stand pipe, a pump house and 4, 6 and 8-in. mains is included. The estimated cost is $37,000. F. W. Thorold, of 2 Toronto St., Toronto, is the engineer.

Welland, Ont.

Tenders will be received by the town clerk, C. M. Webber, until 4 p.m. May 28th, for the construction of approximately 6,000 sq. yds. of pavement in vitrified brick, bitulithic, sheet asphalt, asphaltic concrete, or concrete; also for 360 sq. yds. concrete. Plans and specifications are at the office of the engineer, D. T. Black, and Hugh C. MacLean, Ltd., 220 King St. W., Toronto.

West Kildonan, Man.

The Municipality of West Kildonan proposes to construct pavements on Main St. The contract will be awarded shortly.

Weyburn, Sask.

A by-law providing for extensions to the sewers and watermains, at a cost of $105,000 has been carried by the ratepayers, and tenders will be called shortly. A sewage disposal plant, with septic tanks, will also be installed.

CONTRACTS AWARDED

Chilliwack, B.C.

The contract for the installation of the sewerage system has been awarded by the municipal council to the Robt. McLean and Company, of 744 Hastings St W., Vancouver.

Eastview, Ont.

The contract for the construction of concrete sidewalks on 4 streets has been awarded by the town council to D. Desjardins of this town.

Edmonton, Alta.

The city council has awarded to the Alberta Stone Company of this city a contract for the supply of concrete blocks for sewer manholes.

Hotson, Leader & Goode, of Medicine Hat, have secured from the city council the contract for the construction of 15 miles of concrete walks.

Hull, Que.

The city council has awarded to the Ottawa Construction Company of Ottawa, a contract for the laying of asphalt pavement on Wellington street between Bridge and Montcalm streets.

Kildonan, Man.

The rural municipality of West Kildonan has awarded to the National Paving & Constr. Co., of Winnipeg and Port Arthur, the contract for the construction of 2 miles of 24-ft. pavement on Main Street.

Leduc, Alta.

The [illegible] Construction Company, of Edmonton, has secured from the town council a contract for the construc [illegible] square yards of concrete walks.

New Glasgow, N.S.
The contract for the laying of bitulithic and brick pavements has been awarded to the Warren Bituminous Paving Co. of Ontario Ltd., 130 Bay St., Toronto.

Sandwich, Ont.
The paving contract has been awarded by the town council to Thos. Chick, 225 Bruce Ave., Windsor.

Selkirk, Man.
The contract for the construction of sewers and watermains has been awarded by the town council to L. W. Sghruth, of Winnipeg.

Simcoe, Ont.
The following contracts have been awarded in connection with the completion of the sewage system. S. S. Harper & Sons of St. Thomas, $25,682; pipe Dominion Sewer Pipe Company of Swansea, Ont., $7,500.

Stony Mountain, Man.
The Winnipeg, Selkirk & Lake Winnipeg Railway of Winnipeg, have awarded to the local firm of Kelpin Bros., the grading contract for the extension from Stony Mountain to Stonewall.

Stratford, Ont.
The city council has awarded the following paving contracts: Crawley & McDonald, of Stratford, 6,500 sq. yds. brick pavement at $2.39 sq. yd. on Waterloo St.; J S. Young, Birmingham and Gore Sts., 900 sq. yds. pavement at $1.17 sq. yd. on York St. The city is to supply all reinforcements.

Toronto, Ont.
The following contracts have been awarded by the Board of Control, for sewers: Sherwood & Sherwood, 83 Browning Ave., Armand St., $1,546; Du Vernet St., $724; Fourth Ave., $1,571; 6th Ave., $634; 7th Ave., $1,018; Tomlin Ave., $563. Commr. of Works, City Hall, Neville Park Blvd., $3,100; Ashdale Ave., $420 East Toronto System, $13,900; Glenmanor Drive, $8.100; Glenmanor Drive West, $3,710. Wilks & Wallace, 405 Manning Ave., 3 lanes, $1,540. M. H. Murphy, 84 Dominion St., Gerrard St., $10,227; Bracken St., $2,280. E. Axworthy, 16 Palmerston Gardens, lane off Baldwin, $320; Western Ave., $224. Grant Contracting Co., 50 Front St. E., Widmer St., $530; lane off College. $350. For concrete walks: International Contractors Ltd., 2261 Yonge St.; W. E. Ransom, Dineen Bldg.; Ramsay Contracting Co., 39 Indian Rd. Cres.; A. J. Penberthy, 292 Booth Ave.; A. Johnson, 35 Burgess Ave.; Riverdale Concrete Paving Co., 256 Jones Ave.; Queen City Concrete Paving Co., 179 Broadview Ave.; Standard Concrete Co., 74 Moscow Ave.; Commr. of Works. For pavements: Commr. of Works, asphalt on Clifford, Gertrude, Hain, Inkerman and Logan Ave.; Commr. of Works, concrete on 5 lanes; rocmac on Hain Ave. Asphaltic Concrete Co., 74 King St. E., rocmac on Huntley St., and concrete curbings on Simpson Ave., to R. J. Moyes & Co., 592 Gerrard St. E.

Winnipeg, Man.
The Waterous Engine Works Company, has secured the contract for the supply of a 10-ton 12 h.p. steam roller.

Railroads, Bridges and Wharves

London, Ont.
The construction of a bridge at Richmond St., is being considered by the city council and a by-law will probably be submitted to the ratepayers next January.

Ottawa, Ont.
Tenders will be received by L. K. Jones, Dept. Railways and Canals, Ottawa, until May 26th, for dredging at the upper entrance to the Soulanges Canal. Plans, etc., are at the office of the Department and with the superintending engineer, Quebec City.

Quebec, Que.
Tenders will be received by P. E. Ryan, secretary to the Transcontinental Railway Commissioners, Ottawa, until noon June 2, for the erection of a railway station, with covered platform, on the Champlain Market site. Plans, etc., are at the office of Mr. Gordon Grant, chief engineer, Ottawa, and at the office of A. E. Doucet, district engineer, Quebec.

Simcoe County, Ont.
Tenders will be received by Freeman Campbell, Randall, P.O., until noon May 26th, for the construction of concrete abutments, containing about 100 cu. yds. concrete; for a concrete truss bridge on the townline, Con. XIII, between Tecumseth and W. Guillimbury, over a branch of the Nottawasaga River, about 2 miles south of Cookstown, known as Draper Bridge. Plans are at the office of R. H. Jupp, the county engineer, Orillia, and with the consulting engineer, Frank Barber, 57 Adelaide St. E., Toronto.

Toronto, Ont.
The York County Board of Highway Commrs. propose to build new concrete bridges opposite Lot No. 9, Markham; Lot 28, Con. B. Scarboro; Lot 6, Con. 3, Vaughan. The total estimated cost is $5,500. E. A. James, 79 Adelaide E., is the engineer.

The York township council has decided to build a concrete bridge near Lambton Golf Links and one near Hollys Bush, both across Black Creek. Plans are being prepared by F. Barber, 57 Adelaide E.

The York County Commrs. have decided to erect two 40-ft. steel bridges near Brown Hill, and a 30-ft. concrete bridge near Newmarket. Plans will be drawn by E. A. James, 79 Adelaide E. The estimated cost is $8,500.

CONTRACTS AWARDED

Amherst, N.S.
The Dept. Railways & Canals has awarded to the Rhodes, Curry Company, a contract for 9 girder bridges, to be constructed at the following points, 4 miles west Riviere du Loup; 2 miles west Ste. Helene; Poiverier River Langlier's; ¾ mile west of Riviere Quelle; Holmes' Brook; Sproul's Brook, and Matheson's Cove.

Barrie, Ont.
The town council has awarded to W. D. Minnikin, of Elizabeth St., a contract for the construction of concrete storm culverts on Toronto and Owen Sts.

Ekfrid Twp., Ont.
The following contracts have been awarded by the township council in connection with the bridge construction. Concrete work, F. W. Nicholls, of Appin, Ont.; iron work, W. J. Reader, of Alvinston, Ont.

Ellice and Logan Twps., Ont.
The Perth County authorities have awarded the bridge contract to Jas. Hill, of Mitchell, Ont. ... ...

Fallbrook, Ont.
The Lanark County Council has awarded to the Dickson Bridge Co., of Campbellford, the contract for the construction of a concrete and iron bridge over Mississippi River.

Nanaimo, B.C.
The wharf contract has been let by the Ladysmith Lumber Co., to J. A. Baxter, of Robart St.

Ramsay, Twp., Ont.
The County of Lanark has awarded to Bradford & Serson, of Almonte, Ont., a contract for the construction of a concrete arch bridge over Spanish River.

Virden, Man.
The rural municipality of Virden has awarded to Geo. Harris, a contract for the construction of 5 bridges and 5 culverts on the provincial highway.

Public Buildings, Churches, Schools, etc.

Calgary, Alta.
Local contractors have presented a petition to the government asking them to call for separate tenders instead of a bulk contract for the erection of the new post office on 8th Avenue and 1st street.

Dartmouth, N.S.
Tenders for the erection of a school building are invited by the clerk of the School Board, Alfred Elliot, until May 23rd. Specifications are at the office of the architect, A. R. Cobb, Cragg Bldg., Halifax.

Gananoque, Ont.
Plans for the construction of a skating rink for the Boys' Community Movement are being drawn by Mr. S. McKenzie. The estimated cost is $10,000.

Guelph, Ont.
Plans are being prepared by the Dept. of Agriculture for the erection of a new physics building.

Kemptville, Ont.
Tenders for post office fittings will be received by R. C. Desrochers, Public Works Dept., Ottawa, until May 26th. Plans, etc., are with J. M. Guest Kemptville; Station "F," Toronto; and at the office of the Dept., Ottawa. Specifications are also at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Kintore, Ont.
The contract for the erection of the new Presbyterian Church has been secured by W. Leslie, Church Street, St. Marys.

Kuper Island, B.C.
Tenders for the erection of an industrial school will be received by Duncan C. Scott, Dept. Indian Affairs, Ottawa, until June 9th. Plans and specifications are at the offices of the residential engi-

neer, Public Works Dept., Vancouver; W. E. Ditchburn, Inspector of Indian Agencies, Victoria; W. R. Robertson, Indian Agent, Duncan Station; Post Offices, Nanaimo and Ladysmith, at Indian Industrial School, Kuper Island, and at the Dept., Ottawa.

Lakeside, Ont.
Plans for the erection of a new church are with R. Rawlings, Lakeside, and L. C. McRoberts, Kintore, Ont. Tenders will be received until May 25th.

Lethbridge, Alta.
Clemesha & Portnall, of Credit Fancier Bldg., Regina, are drawing plans for the erection of an Anglican Church with hall and rectory. The estimated cost is $150,000.

London, Ont.
Tenders for alterations to the collegiate, on Dufferin Ave., will be received by the Board of Education, until May 26th. Architects, McBride & Gilbert, Edge Block.

Melita, Man.
Tenders for the erection of a post office building will be received by R. C. Desrochers, Public Works Dept., Ottawa, Ont., until June 4th. Plans, etc., are at the office of H. E. Matthews, architect, Winnipeg, P. O. Melita, and Dept., at Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Mille Roches, Ont.
The school contract has been awarded to Williams & Evans, of Cornwall, Ont. The contract for heating is not yet let.

Napanee, Ont.
Tenders for the erection of a drill hall will be received by R. C. Desrochers, Public Works Dept., Ottawa, until June 5th. Plans are at the office of the Dept., and Post Office, Napanee. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

North Regina, Sask.
The erection of a municipal hall and a public school is being considered by the North Regina Council.

Ottawa, Ont.
Plans are in progress for certain alterations to Knox Presbyterian Church at a cost of $25,000. J. P. MacLaren, of Sparks St., is the architect.

It is now proposed that the Ottawa Canoe Club, Rockcliffe, amalgamate with another club and build a $30,000 canoe club house.

Weeks and Burgess, architects, of Sparks Street, are preparing plans for the erection of a Sunday School for the First Congregational Church.

Plans for the erection of a sulphite mill on Head street at a cost of $35,000, have been prepared by J. R. Booth, lumber merchant, Bridge street, who also has plans drawn for a $20,000 timber mill on Chaudiere street.

Owen Sound, Ont.
The ratepayers will be asked to vote on June 6th (1) exemptions for ten years to Canada Yeast Co.; (2) [illegible] loan to Union Cement Co.; (3) bonus of $10,000 per year for 20 years to a shipbuilding concern.

Rankin, Ont.
Tenders on the erection of a new church are about to be called by the St. Thomas Church authorities. Architect, C. P. Meredith, 126 Sparks St., Ottawa.

Sandwich, Ont.
Tenders for the erection of a school building will be received by the School Board Secretary, David Tasker, until 6 p.m. June 6th, excepting heating, plumbing and ventilating, tenders for which will also be received separately. Plans, etc., are at the office of the architects, Ed. C. VanLeyen and Ed. A. Schilling, 1115-21 Union Trust Bldg., Detroit, Mich.

Shoal Lake, Man.
Tenders for the erection of a church building will be received by Thos. Short, Sec.-Treas. to the Church Trustees, until May 25th. Specifications are with the Sec.-Treas., and at the Builders' Exchange, Winnipeg.

Star City, Sask.
Tenders will be received by H. H. Sherriff, Sec.-Treas., School Dist. No. 1475, until 10 a.m. May 30th, for the erection of additions to the school building.

Sussex, N.B.
Tenders will be called shortly for the erection of the agricultural college. G. Ernest Fairweather, 84 Germain St., St. John, N.B., is the architect. Estimated cost $25,000.

Toronto, Ont.
Plans are about to be prepared for the erection of a Parish Hall and Sunday School for St. Barnabas Anglican Church, Danforth Ave.

Dr. Hastings and Mr. Rowland, Chairman of the Board of Health, are considering the erection of additional Isolation Hospital Bldgs., on the site of the Jail Bldg.

Plans are prepared for the new building to be erected at the city jail farm on Yonge St., to accommodate 100 prisoners.

The Christian Science Church, on University Ave., has been purchased by the order of Mystic Shriners, and will be remodelled into a hall and lodge rooms. Chairman Bldg. Co., W. H. Shaw, Crescent Rd.

The Board of Control has decided to erect a new central police station. The building will contain administrative offices, court rooms, etc. The cost is estimated at $350,000.

Principal McKay has presented his estimates for equipment for the new Central Technical School amounting to [illegible]

Plans for moving picture theatre have been drawn by J. H. Stanford, Bloor & Ossington streets, for S. Sniderman, [illegible] College street.

H. L. Wood & Co., Noble St., propose erecting a [illegible] brick warehouse on Queen Street West.

Toronto, Ont. (Fairbank)
Tenders for the erection of Fairbank Presbyterian Church are invited by the Architect, W. R. Gregg, 23 Jordan Street, Toronto. The building is to have a seating capacity of $500.

Trail, B.C.
A site has been selected by the Public Works Department for the erection of a post office.

Wapella, Sask.
Tenders will be received by Thos. F. Terry, Box No. 196, Wapella, Sec.-Treas. to the Public School Board, until June 1st, for (1) excavating and cementing basement; (2) steam heating plant; (3) carpentry work, in connection with the erection of a new school.

West Burnaby, B.C.
The competitive plans of J. H. Bowman, architect, Yorkshire Bldg., Vancouver, were accepted for an 8-room frame school building. Tenders will be called shortly.

Windsor, Ont.
Plans for the construction of an abattoir are being drawn for the Central Ice and Storage Company by T. Z. Humphries, Royal Bank Building.

Winnipeg, Man.
J. K. Semmens, architect, of McArthur Block, is drawing plans for the new public library at Fort Rouge. The estimated cost is $43,000.

Plans for the erection of a public library, at North End, at a cost of $43,000, are being drawn by F. Peters, architect, Phoenix Block.

H. W. Greene, of the McGreevy Bldg., is drawing plans for the erection of a new church for St. Jude's Congregation.

Tenders will be received by the Board of Control until May 27th, for replacing wooden floors with reinforced concrete at Fire Stations Nos. 1, 2, 3, 4, 5, 6, 7 and 8. Specifications are at the office of J. E. Buchanan, Fire Dept. Chief.

CONTRACTS AWARDED

Brantford, Ont.
The following sub contracts have been awarded in connection with the erection of Rawdon St. School. Veneilating and heating, Dominion Radiator Co., Ltd. (standard system); plumbing, R. H. Ballantyne, 3 King St.

Coaticook, Que.
The drill hall contract has been awarded by the Public Works Department to the local contractor, Wm. Welch.

East Angus, Que.
The Sherbrooke Constr. Co., of Sherbrooke, has secured the contract for the erection of a school building for the R. C. School Commissioners.

Fredericton, N.B.
The contract for the installation of a heating system at the normal school building has been let to the Smith Foundry Company of this city.

Lindsay, Ont.
The following contracts have been awarded in connection with the erection of Cambridge St. School. General contractor, G. H. Lindsay, Kent St.; roofing, heating and plumbing, Boxall & Matthie, Kent St.

Lethbridge, Alta.
The Separate School Dist. have awarded to Lee & Bigler, of Edmonton, the contract for the erection of an eight room school.

Medicine Hat, Alta.
The following contracts have been awarded on the erection of the home for delinquent children, in City Park. General contractor, F. S. Maddock; heating and plumbing is not included in the contract. Three storeys, [illegible]

(Continued on page 81)

Tenders and For Sale Department

Tenders for School

Sealed tenders will be received by the undersigned up to May 27, 1914, for the erection of an 8-roomed school building in the village of Paisley.

Plans and specifications may be seen at the office of Jas. L. Russell, architect, Stratford, The Contract Record & Engineering Review, 220 King Street West, Toronto, or at the office of the undersigned at Paisley.

Lowest or any tender not necessarily accepted.

W. R. BARNETT,
Secretary of the School Board,
[illegible] Paisley, Ont.

CITY OF REGINA

Tenders for Trenching and Laying Water Mains

Sealed tenders, marked "Laying of Water Mains," will be received by the City Commissioners, Regina, Sask., up till noon, **May 25th, 1914**, for the trenching and laying of Water Mains on certain streets in the City of Regina.

Specifications and other information may be received at the office of the undersigned.

A marked cheque covering five (5 p.c.) per cent. of the tendered amount must accompany each tender.

The City Commissioners reserve the right to reject any or all tenders.

J. M. MACKAY,
[illegible] Superintendent of Waterworks.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Drill Hall, Napanee, Ont.," will be received at this office until 4 p.m. on **Friday, June 5, 1914**, for the above mentioned Drill Hall at Napanee, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Napanee, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, May 11, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—56625.

CITY OF MOOSE JAW

NOTICE

Sealed tenders marked "Tender for Street Paving," "Manhole Frames and Covers," or "Lead Pipe," addressed to the City Commissioners, Moose Jaw, Saskatchewan, will be received up to 10 a.m. on **Friday, June 5th, 1914**, for the following:—

Contract No. 85, for approximately 19,000 square yards street paving.

Contract No. 86, for 295 Cast Iron Hanhole Frames and Covers and 200 Catchbasin Frames.

Contract No. 87, for 52 tons of ⅝-in. lead pipe, and 5 tons pig lead.

Plans may be seen and specifications and form of tender obtained at the City Engineer's office. A deposit of five dollars will be required for each set of the specifications, which deposit will be returned on receipt of a bona fide tender.

Each tender must be accompanied by a marked cheque payable to the order of the City Treasurer for five (5 p.c.) per cent. of the value of the total cost of each contract.

The Commissioners do not bind themselves to accept the lowest or any tender.

JAMES PASCOE, Mayor,
GEO. D. MACKIE,
W. F. HEAL, City Commissioners.

Dated at Moose Jaw, this 18th day of May, 1914. 20-21

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, May 29th, 1914
for enlargement of

Eglinton Avenue School
All trades

Ryerson School
Heating and Ventilating Plumbing
Electric Wiring

Strathcona School
Heating and Ventilating Plumbing
Electric Wiring
also

Williamson Road School
Moving House

King Edward School
Mason Work Ash Hoist

Cabinet Work—Several Schools

Paint Materials—Lead, Oil and Turpentine, etc.

Sale of Old Houses

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

All tenders must be on revised forms.

W. C. WILKINSON,
Secretary-Treasurer.
J. W. JACKSON,
20 Chairman of Committee.

Tenders for Steelwork

Sealed tenders addressed to J. B. Cote, Secretary, and marked "Tenders for Provencher Bridge," will be received up to 12 o'clock noon, **Saturday, the 20th day of June**, for supply and erection of the superstructure for the Provencher Avenue Bridge over the Red River between St. Boniface and Winnipeg.

Plans and specifications may be seen and forms of tender obtained at the offices of:—

The City Engineer, St. Boniface, Man.
The City Engineer, Winnipeg, Man.
Contract Record, Toronto, Ont.
Canadian Engineer, Montreal, Que.
Pittsburg Testing Laboratories, Pittsburg.
Engineering News, New York.
Strauss Bascule Bridge Co., Chicago.

All tenders to be accompanied by a marked cheque or bid bond for $10,000.

The lowest or any tender not necessarily accepted.

J. B. COTE, Secretary,
19-23 City Hall, St. Boniface, Man.

Department of Railways and Canals.

Soulanges Canal

Notice to Contractors

Sealed tenders, addressed to the undersigned, and marked "Tender for Dredging to be done in connection with Protection Works, Upper Entrance, Soulanges Canal," will be received at this office until 12 o'clock noon on **Tuesday, May 26th, 1914.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Quebec Canals, Montreal.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of $1,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderers will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,

Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 11th May, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—61188. 20

Private Residence

Sealed tenders will be received up to noon, **May 23, 1914**, for the erection of a residence for the Director of the Meteorological Service on Devonshire Place near Bloor Street, Toronto, for the Department of Marine and Fisheries, Ottawa.

Tenders will be received in bulk only. A certified cheque for ten per cent. of the amount of the tender must accompany same.

Plans and specifications may be seen at the office of the undersigned, to whom tenders must be delivered on or before the above date.

J. W. SIDDALL, Architect,
250 Confederation Life Bldg.,
20 Toronto, Ont.

Sealed Tenders Wanted

Sealed tenders will be received by David Tasker, Secretary, the Public Schools of the Town of Sandwich, Essex County, Ontario, until six o'clock p.m. on the **6th day of June, 1914**, for the general contract of an eight-room reinforced concrete public school building, except plumbing, heating and ventilating.

Tenders for plumbing, also for heating and ventilating of the same building will be received at the same place, time and date.

All proposals shall be in accordance with plans and specifications, copies of which are on file at the offices of the Architects, Edward C. Van Leyen and Edward A. Schilling, 1115-21 Union Trust Building, Detroit, Michigan.

Copies of the plans and specifications can be had by applying to the aforesaid architects and making a deposit of $20 for the care and safe return of drawings.

Tenders shall be accompanied by a certified cheque or bidding bond in the sum of of five per cent. of the amount of proposal, payable to the Public Schools of the Town of Sandwich, as a guarantee to furnish satisfactory bond and entering into contract.

The Board reserves all rights under the specifications to accept or reject any or all bids.

DAVID TASKER, Secretary.
The Public Schools of the Town of Sandwich.
19-20

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Public Building, Milton, Ont.," will be received at this office until 4.00 p.m., on **Thursday, May 28th, 1914**, for the construction of a Public Building at Milton, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Toronto, Ont., at the Post Office, Milton, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, May 6, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—61190. 19-20

TENDERS

Will be received by the undersigned up to **May 30, 1914**, for the assets of the Moose Jaw Pressed Brick Company, Limited, Moose Jaw, Sask., valued at $44,760. Included in these assets are thirty-eight acres of land, situated within the city limits of Moose Jaw, and valued at $15,550, buildings to the value of $6,000, and plant, $19,500. This plant is located in a city in which there is a good demand for the product, and could be developed into a very profitable business under proper management. Marked cheque for $100 must accompany each tender, which will be returned in the case of unsuccessful tenderers. The highest or any tender not necessarily accepted.

Further particulars regarding the above may be obtained from the undersigned.

CANADIAN CREDIT MEN'S TRUST ASS'N
20 502 Leader Bldg., Regina, Sask.

Tenders Town of Welland Pavements

Tenders are invited for the construction of approximately 6,000 square yards of pavement in Vitrified Brick, Bitulithic, Sheet Asphalt, Asphaltic Concrete, or Concrete, also for 360 square yards of concrete.

Plans and specifications may be seen at the office of the Canadian Engineer, 62 Church St., Toronto, or office of Contract Record, 220 King Street West, Toronto. Plans and specifications, etc., may also be seen at office of Town Engineer, Welland, where bidding forms and all other information may be received.

Sealed tenders fully endorsed are to be deposited with the Town Clerk, Town Hall, Welland, not later than 4 p.m. on **Thursday, May 28th, 1914**.

An accepted bank cheque valued at 10 per cent. of tender price must accompany each bid.

The Council do not bind themselves to accept the lowest or any tender.

D. T. BLACK, Town Engineer.
Engineering Department,
Welland, May 8th, 1914. 19-20

TOWN OF WALKERVILLE

Tenders for Sidewalks

Sealed tenders will be received by registered post addressed to the undersigned up to noon on **Monday, the 25th day of May, A.D. 1914**, for the construction of sidewalks in the Town of Walkerville, as follows: -

On both sides of Niagara street from Lincoln Road to westerly limits.

On Argyle Road from Huron to Ottawa streets on the east side, and from Huron to Ontario streets on the west side.

[illegible] to Ottawa streets.

[illegible]

[illegible] tario to Ottawa Street.

[illegible]

[illegible] westerly limits.

[illegible]

[illegible] turned.

The lowest or any tender not necessarily accepted. The names of two responsible persons [illegible]

[illegible]
20 [illegible]

Club Building

Sealed tenders will be received up to **June 1st** for all trades in connection with the erection of a Club House for the Parkdale Canoe Club. Both bulk and separate tenders will be considered.

The lowest or any tender not necessarily accepted.

Plans and specifications may be seen, and tenders received, at the office of the architect, Mr. George N. Molesworth, 2 College St., Toronto.
20

Tenders for Circular Brick Chimneys

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, June 9th, 1914**.

Circular Brick Chimneys

Specifications and forms of tender for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, May 15th, 1914. 20

Sewers

Belhaven Road, from Wrenson Road to Gerrard Street.

Gerrard Street, from Morley Avenue to 105 ft. east of Redwood Avenue.

[illegible] to Gerrard Street.

Moore Park Drainage System, Eastern Section, outlet from Glen Road and C. P. R. to north end of Harper Avenue via C. P. R., lane south from Ethel Cres., Ethel Cres., Reserve Strip at east end of Rosehill Ave., Rosehill Ave., and Harper Avenue.

[illegible] Ave. to 92 ft. 3 in. east of Sherwood Avenue.

[illegible] forth Avenue.

[illegible] Keystone Drive.

Terauley Street, north side Queen Street to south side Elm Street.

[illegible] marked on the outside as to contents. Specifications [illegible] tained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with [illegible] of by the City Treasurer, or in lieu of said sure [illegible] strictly complied with.

The lowest or any tender not necessarily accepted.

[illegible]

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Drill Hall, Barrie, Ont.," will be received at this office until 4 p.m. on **Wednesday, May 27, 1914**, for the con construction of the aforesaid building.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., on application to the Caretaker, of the Post Office, Barrie, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occuptions and places of residence. In the case of firms, the actual signature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order the Honourable the Minister of Public Works, equal to ten per cent (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works.
Ottawa, May 4, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—60712.

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Drill Hall, Listowel, Ont.," will be received at this office until 4 p.m., on **Monday, June 1st, 1914**, for the construction of the aforesaid building.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, on application to the caretaker of Post Office, Listowel, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occuptions and places of residence. In the case of firms, the actual signature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works.
Ottawa, May 6, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—60102. 19-20

Tenders
for
Bridge Construction

Sealed tenders plainly marked as to contents will be received by the undersigned, up to noon of **Tuesday, May 26th, 1914**, for the construction of a concrete arch culvert (containing about 102 cu. yds. concrete at Willowdale on Yonge Street, County of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted

FRANK BARBER,
County Engineer.
Toronto, May 11, 1914. 20

CITY OF WINNIPEG

Tenders for Street Name Posts and Name Plates

Sealed tenders addressed to the Chairman, Board of Control, will be received at the office of the undersigned up to 11 a.m. on **Monday, June 15th, 1914**, for the supply of street name posts and name plates.

Tenderers are invited to submit their own designs and specifications, including illuminated signs.

M. PETERSON, Secretary.

Board of Control Office,
Winnipeg, May 5th, 1914. 19-20

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Public Building, Norwich, Ontario, will be received at this office until 4 p.m., on **Thursday, May 28, 1914**, for the construction of the building mentioned.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., The Postmaster, Norwich, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occuptions and places of residence. In the case of firms, the actual signature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works.
Ottawa, May 5, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—60099. 19-20

Bridge Tenders

Sealed tenders will be received by C. McNabb, Esq., Rockwood, Ont., up to **Wednesday, May 27**, for the construction of six small, reinforced concrete beam or arch bridges in the county of Wellington. For plans, specifications and all information, apply to

C. McNABB, Rockwood, Ont.
J. M. YOUNG, Harriston, Ont., or
BOWMAN & CONNOR,
16 King Street West,
Toronto, Ont.

20

TRANSCONA, MAN.

Water Supply System and Sewerage System

Sealed tenders will be received by the undersigned until twelve o'clock noon, **May 30th, 1914**, for the supply of materials and labor for the above works:

Contract (1) For Well Drilling.
Contract (2) For Water Pipe and Special Castings.
Contract (3) For Hydrants, Valves and Valve Boxes.
Contract (4) For Laying Water Pipe and appurtenances.
Contract (5) For Sewer Pipes.
Contract (6) For Sewer Castings.
Contract (7) For Constructing Sewers.

Plans, specifications, etc., may be had at the office of W. M. Scott, Engineer, 204 Sterling Bank Bldg., Winnipeg.

A deposit (cheque) of $25.00 will be required for each set of plans and specifications for Contracts (4) and (7). This will be returned when plans are returned in good condition at or before the date tenders close.

The lowest or any tender not necessarily accepted.

G. P. CAMPBELL, Sec.-Treasurer,
Town of Transcona, Man.
20-21

Tenders
for
Annual Supplies

Trap Rock

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, May 26th, 1914.**

TRAP ROCK

Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, May 5th, 1914. 20

To Contractors

Bulk or separate bids addressed to the undersigned, will be received up to noon of **Saturday, May 23rd, 1914**, for all trades required in the erection of a residence at "Brantwood Survey," Oakville, Ont.

The lowest or any bid not necessarily accepted.

F. S. BAKER, Architect.
Royal Bank Building, Toronto. 19-20

Library Tenders

Whole or separate tenders will be received by the undersigned till noon of **Friday, May 29th**, for the several trades in connection with the erection of a Carnegie Free Library at Midland.

Plans and specifications may be seen at the Library building or at the office of the architect, W. A. Mahoney, Telephone Building, Guelph.

Lowest or any tender not necessarily accepted.

20 H. J. CRAIG, Secretary.

Township of South Dumfries

30 Foot Highway Bridge

Sealed tenders clearly endorsed on the outside "Tender for Superstructure," will be received by the Township of South Dumfries up to 6 p.m. on **Saturday, the 30th of May, 1914**, for the manufacture and erection of a Class "A" steel highway bridge with 16-foot roadway and 30-foot clear waterway on the Harrisburg Road over the North Branch of Fairchild's Creek about one-quarter mile southeast from the G. T. R. Station of St. George.

Specifications may be had from Jackson & Company, Temple Building, Brantford.

Tenders should be addressed to the Township Clerk, H. Maus, Esq., Paris. The Council does not bind itself to accept the lowest or any tender.

ALAN MAIR JACKSON,
20-21 Township Engineer

CITY OF KELOWNA, B. C.

Tenders Wanted

Tenders in duplicate for the supply of the following apparatus F.O.B. cars Kelowna, B.C., will be received by G. H. Dunn, City Clerk, up to 12 o'clock noon on **Thursday, June 11th, 1914**:

One—225 B.h.p., Vertical, Two Crank Compound Steam Engine.

One Feed Water Heater.

One Independent Air Pump and Jet Condenser.

One—150 Kilowatt, 2300 Volt, Three Phase, 60 cycle, Alternating Current Generator for direct connection to engine.

One—Exciter for direct connection to Generator.

One Switchboard Panel to match present switchboard.

Deposit cheque of 5 per cent. required.

The lowest or any tender not necessarily accepted.

Specifications may be seen after May 25th, 1914, at the following offices:

Canadian Engineer, Montreal.
Canadian Engineer, Winnipeg.
Electrical News, Toronto.
Electrical News, Vancouver.

or may be obtained from the Consulting Engineer's Branch Office at Vernon, B.C.

C. R. YUILL,
Successor to
Mather, Yuill & Company, Limited,
20-22 Consulting Engineers

Contracting Superintendent

Wanted.—Superintendent for electrical contracting business having estimating experience. Apply giving full particulars to Box 26, Electrical News, Toronto. 11-12

Sales Agents

Large United States firm manufacturing concrete chutes, screens, car movers and other engineering and contracting specialties wants representatives in **Canada**. Write advising what section you can cover, to Box 22, Contract Record & Engineering Review, Toronto. 19-21

Form Clamps

We are the largest United States manufacturers of form clamps for concrete work, and desire to secure sales agents in various parts of Canada. Our clamps are used by the best construction companies on the Continent. Apply Box 23, Contract Record & Engineering Review, Toronto. 19-20

Business Opportunity

For Sale—Woodworking shop fitted especially for general work such as interior trim, doors, sash, etc. New and up-to-date machinery. First class dry-kiln. Blower system. Railway siding. Situated in a thriving Ontario town. Splendid local and shipping trade.

This is an exceptional chance to buy a bright business with a trade already established.

Write to J. A. C., care Contract Record, Toronto. 19-20

Public Buildings, Churches, Schools, etc.

(Continued from page 77)

brick construction. Other details, previously reported, on request

Montreal, Que.
The contract for tile and marble work on the alterations to Esplanade Ave. School have been awarded to the Dom. Floor & Wall Tile Company.

Montreal, Que., Rockfield
The School Commrs. of Coteau St. Pierre, Aberdeen School, have awarded to Reid, MacGregor & Reid, Guy Block St. Catherine W., the contracts for the erection of 2 school buildings.

Ottawa, Ont.
The contract for steel work on the erection of the Glebe Methodist Church has been let to the Dickson Bridge Co., of Campbellford, Ont.

Regina, Sask.
Frid Lewis & Co., McCallum Hill Bldg., have secured the police station contract.

Toronto, Ont.
The following contracts have been awarded in connection with the erection of a church on Dufferin St., for the Italian community. Masonry, Fred Holmes & Son, 1105 Yonge St.; carpentry, O. S. Deforest, 67 Westmoreland Ave.

Business Buildings and Industrial Plants

Ayer's Cliff, Que.
Plans for the erection of a rake and shovel factory have been drawn by the Rugg-Ball Mfg. Co., Ltd., of Sherbrooke, to this city.

London, Ont.
Plans are in progress for alterations to the King and Richmond St. Rink. The architects are McBride & Gilbert, Edge Block.

Markham, Ont.
The Metropolitan Bank has purchased a site on Main St., with a frontage of 45 feet for the erection of a branch office.

S. Todd has purchased a site with a frontage of 55 feet, and proposes erecting a store and residence thereon.

Medicine Hat, Alta.
The city council is having plans prepared for the erection of stables at a cost of $15,000. Bourne & Morrison are the architects.

Montreal, Que.
The following sub-contracts have been awarded in connection with the erection of the Molson Bank building on St. Lawrence and Ontario streets. General contractor, J. H. Hutchison, 10 Cathcart street. Plumbing and electrical, L. E. Moulton & Co., Ltd., 955 St. James Street.

Montreal, Que., Verdun
Plans for the erection of stores and residence, at a cost of $15,000, are being drawn for A. Bailie, by Daniel J. Crighton, Jacobs Bldg., Montreal.

Niagara Falls, Ont.
Plans for the erection of store and flats, at a cost of $7,000, have been drawn by E. D. Pitt, Victoria Ave.

Port Rowan, Ont.
Austin Becker, Main St., has drawn plans for the erection of a picture theatre. Estimated cost $5,000.

Regina, Sask.
Regina Plumbing and Heating Company are making extensions to their warehouse, and tenders are now being received by the architects, Storey & Van-Egmond, 1014 McCallum Hill Bldg.

Leitch Bros. Milling Co., of Oak Lane, Man., propose to erect a flour mill with a capacity of 3,000 bbls. per day and an auxiliary plant for sack making.

Sherbrooke, Que.
Machine shop plans for the Sherbrooke Machinery Co., are being prepared by H. G. James, architect, Whiting Block.

Steveston, B.C.
J. N. Trites, of Trites, Ltd., Vancouver, proposes to erect a business building on Lulu Island.

Toronto, Ont.
The Sutherland Constr. Co., of 315 Ryrie Bldg., are open for tenders on The Solman Hotel; Todmorden School; I. O. F. Orphanage, Oakville, and the Bank of Commerce, Waterloo.

The Chisholms Corporation, Ltd., Traders Bank Bldg., has purchased from the Provincial Government on Metagami River and will construct a pulp mill with a capacity of 75 tons per day.

Vancouver, B.C.
The Shull Lumber & Shingle Co., of Everett, Wash., U.S., proposes erecting a shingle mill having a daily capacity of 1,000,000 shingles.

Welland, Ont.
The contract for enlarging "Dexter" Hotel has been let to J. C. Diffin, 261

[illegible] Ave. General hotel furnishings will be required.

CONTRACTS AWARDED

Hanna, Alta.

The [illegible] Company of Calgary, has secured the contract for the erection of stores and offices for A. J. [illegible]

Montreal, Que.

The following contracts for alterations to the Royal Bank of Canada, Dorchester W. and Beaver Hall Hill, has been let to [illegible] & Henderson, McGill Bldg. The heating and plumbing will be installed by McKnight & Blackadder.

A contract for stores, etc., on Mt. Royal Ave., has been awarded by W. H. Bolton, to Laird Paton & Son, Ltd., 485 St. James St.

The contract for the erection of a branch bank on St. Lawrence St., for the Bank of Montreal, has been awarded to C. E. Deakin, Ltd., 41 Mayor St.

E. G. M. Cape, Ltd., has secured the contract for the foundation of the Liverpool, London & Globe Assur. Co. office building on Dorchester St. W. The architects, Nobbs & Hyde, and J. R. Gardiner, are taking tenders for general contractor, and separate tenders for heating and plumbing.

Nanaimo, B.C.

A contract for a store and office building has been awarded by J. B. Nicholson, Victoria Crescent, to Watson, Jacks & Anderson.

Ottawa, Ont.

The contract for the erection of the Rideau and Waller Sts. branch of the Bank of Ottawa, has betn let to Alex. Christie, Elgin St.

Residences

Hamilton, Ont.

Plans for the erection of an $18,000 apartment house on Park street south for J. A. C. Morrow, 217 Caroline street, are being drawn by Geo. T. Evans, Bank of Hamilton Bldg., who will call tenders shortly.

Medicine Hat, Alta.

A permit for the erection of a $40,000 apartment house on 4th Ave. and Ottawa St., has been issued to Thos. Montgomerie, Hull Block.

Montague, P.E.I.

The plans for J. W. Carruthers' proposed residence are to be altered, and it is probable that the building will not be erected until 1915. Architect, C. B. Chappell, Box 93, Charlottetown.

Montreal, Que.

Tenders for the erection of a residence on Carleton Ave., for Miss Elliott, are invited by the architects, Turner & Carless, 49 Beaver Hall Hill.

Plans for the erection of a $20,000 apartment house on St. Luke street have been drawn by C. Dufort, 192 St. Catherine St. W., who invites tenders for excavating.

A permit for the erection if 2 residences, on Minto St., at a cost of $12,000, has been issued to H. Paradis, 419 North-[illegible]

The contract for the erection of flats and garage on Demontigny street east for N. Davi, has been let to J. Boucher, 60 St. Clothilde street.

Montreal, Que. (Outremont)

Laurent Freres, 635 Papineau Avenue, have secured the contracts for the erection of two residences on Ainstie Ave., for Messrs. Ouellette and Tourville.

Ottawa, Ont.

N. Hollister, 512 Bay St., will probably erect a $15,000 apartment house on McLaren St.

Christian Neilson, 111 Lees Ave., proposes to erect a $6,000 apartment building on Concord St.

A contract for the erection of a residence on First Ave., for Mrs. M. O'Meara, has been let to John Baird, 196 Fifth Ave.

Pt. Grey, B.C.

A permit for the erection of a $15,000 residence, on 40 Belmont Ave., has been granted to Jas. McWhinney, 2335 6th Ave. W.

Regina, Sask.

Tenders on the erection of a $10,000 residence are invited by the architects, Storey & VanEgmond, 1014 McCallum Hill Bldg.

Sherbrooke, Que.

F. B. Wilson, Quebec St., proposes to erect a residence on Dominion Ave. H. G. James, Whiting Block, is the architect.

Toronto, Ont.

Separate tenders on the erection of 2 detached residences on Arlington Ave. are invited by T. L. Odell, 279 Sherbourne street.

Bulk tenders only for the erection of a residence on Devonshire Place will be received by the architect, J. W. Siddall, 250 Confederation Life Bldg., until noon, May 23rd, at whose office plans may be seen.

Tenders for the erection of two residences on Wellesley street will be received by A. B. Campbell, care McArthurs Smith Company, 34 Yonge St.

Plans for the erection of a $5,000 residence on Dowling Ave., have been drawn by A. F. Fury, 154 Dowling Ave.

W. C. Miller Co., 311 Ryrie Bldg., invites tenders for plastering and painting on a residence on Roxboro Street.

Tenders on the erection of 2 detached residences, on Indian Rd., are invited by the architect, J. E. Walker, 415 Ryrie Bldg.

Tenders are invited on a residence, in St. Andrews Gardens, for Mr. S. Smith. Architect, Gordon M. West, 2 College St.

Tenders for the erection of a rectory, on Ravensden Ave., for St. Clare Roman Catholic Church will be received by Rev. Mr. McCabe, 4 Ravensden Ave.

Trenton, Ont.

Tenders on a $5,000 residence, on Henry St., will be received by the architect, George Kelly, until May 23rd.

Vancouver, B.C.

Tenders on the alterating of buildings on 10th and Main Sts., are invited by the architect, Jesse M. Warren, 503 Central Bldg., Victoria.

Windsor, Ont.

Leo Page, of Ojibway, Ont., proposes to erect a $12,000 residence.

Tenders for the erection of a $15,000 residence on Victoria street will be received by the architect, J. C. Pennington, LaBelle Bldg., until May 31st.

Winnipeg, Man.

Andrews Bros., Portage Ave. and Victoria street, are preparing plans for the erection of a $17,000 residence.

Tenders for the erection of an apartment block will be received by the architects, Hooper & Davis, Notre Dame Investment Bldg., until May 27th. Estimated cost $30,000.

Recent permits include, A. Heilig, apartment block, to cost $70,000; D. H. James, residence, to cost $5,000; North Winnipeg Constr. Company, apartment block, to cost $35,000.

CONTRACTS AWARDED

Barrie, Ont.

The following sub contracts have been awarded on a residence on Kempenfeldt, for Mr. Douglas Stewart. Concrete, brick and tile work, R. Bull, of Collingwood; painting, Phil. Love, Mulcaster St.

Hamilton, Ont.

The masonry contract in connection with the alterations and additions to a residence on James St. S., has been let to H. C. Gummo, 15 Tuckett St.

Knowlton, Que.

A contract for the erection of a summer residence for Wm. Scully, of Montreal, has been let to C. S. Richard, Knowlton.

Montreal, Que.

The following contracts have been awarded on the alterations to flats on St. Mark, for Mr. Badgley. General contractor, W. M. Irving, Guy Block, Montreal; roofing, Hickey & Aubut, 93 Dominion St.; heating and plumbing, White & Delany, Metcalf St.

The following sub contracts have been awarded in connection with the erection of a residence, on Redpath Crescent, for Walter E. Lyman. Carpentry, U. Pauze & Fils Co., 326 Green Ave.; tile, Lautz Dunham Co., Ltd., 45 St. Alexander St.; plastering, Mcnulty Bros., 182 Mountain; heating and plumbing, T. Lessard & Sons, Ltd., 191 Craig E., electrical, Stevenson Constr. Co., 15 Union Ave.

The following contracts have been awarded in connection with the erection of a residence on Mountain St., for W. M. Kearns. Masonry, plastering and carpentry, A. K. Hutchison, New Birks Bldg.; roofing, Standard Roofing Co., 189 McCord St.; painting, W. H. Reid, 442 Prince Albert Ave.; heating and plumbing, D. A. Bethune, 483 Bleury St.; electrical, Stanley B. Chauvin, 246 Amherst St.

Montreal, Que., Cote St. Luke

The following sub contracts have been awarded on a residence for Lawrence A. Wilson. General contractor, M. J. Aquin, Lachine; heating and plumbing, Hickey & Aubut, Dominion St., Montreal; electrical, Marchand Freres, 107 Lagauchetiere W. The architects Finley & Gagnon, New Birks Bldg., Montreal, will take tenders in a few days for barns and stables.

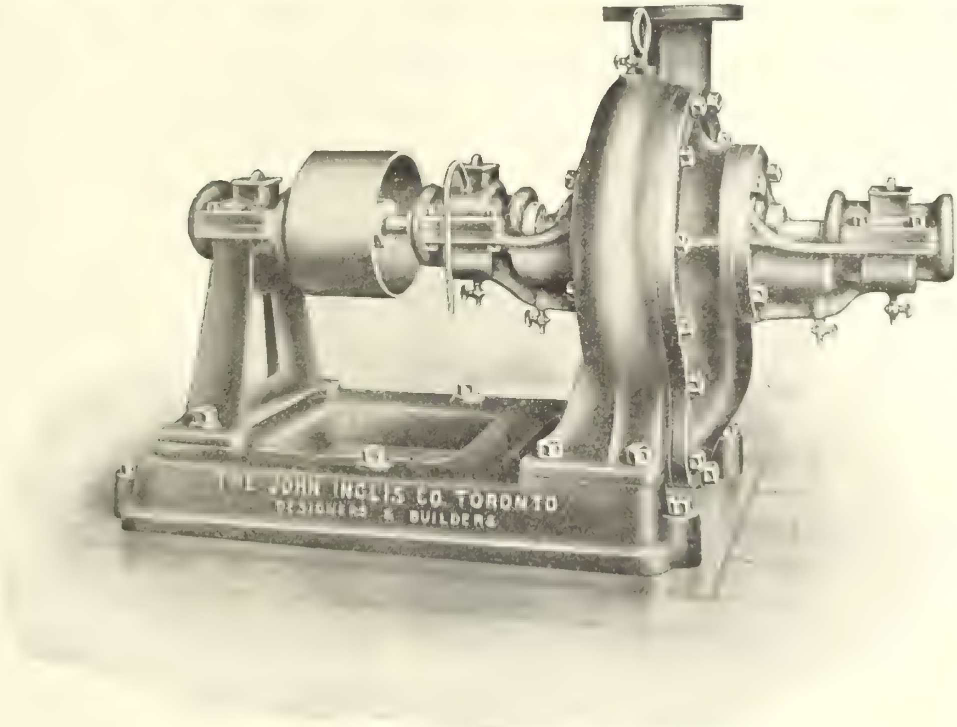
Montreal, Que., Pt. Claire

L. Beaudry, 2420 Hutchison St., Montreal, has secured the contract for the erection of Dr. F. T. Tooke's cottage.

St. John, N.B.

The following contracts have been

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

[illegible] on a residence, barn and bakery on H. Jewell, Victoria St. Masonry, Jas. Sirrill, 81 Princess St., carpentry, J. A. McDonald, Water St.

Toronto, Ont.

The contract for addition to E. R. Woods' residence, 84 Queens Park, has been secured by T. Cannon & Son, 75 Brock Ave.

The contract for the masonry on detached residence for Mr. R. A. Laidlaw, (Jackes Ave.), has been awarded to Witchall & Son, 163 Havelock St.

Power Plants, Electricity and Telephones

Assiniboia, Sask.

The installation of a power plant is being considered by the village council. Murphy & Underwood, of Saskatoon, are the engineers.

Calgary, Alta.

The ratepayers have refused to sanction the expenditure of the sum of $300,000 on extensions to the electric lighting system.

Colborne Twp., Ont.

The purchase of a telephone equipment is contemplated by the Goderich Telephone Company.

Essex, Ont.

The town council contemplates installing a dynamo, motor and pump and laying mains to connect Garrow well with the town system.

London, Ont.

It is understood that the Bell Telephone Company will build long distance lines between Sarnia, Petrolea and London.

Regina, Sask.

The contract for 2 sections of economizers has been awarded to the B. F. Sturtevant Company.

Province of Saskatchewan.

Tenders are invited for the construction of the following lines: Latham Rural Telephone Co., head office Osage sec.-treas., C. H. Mitchell; West Osage Rural Telephone C., head office Osage, sec.-treas., R. C. Allbough; Morris Rural Telephone Co., head office Osage, sec-treas., F. W. Butterfield; Osage Rural Telephone Co., head office Osage, acting sec.-treas., L. J. Kelly. Specifications are at the Department of Telephones, Parliament Bldgs., Regina.

Winnipeg, Man.

Tenders will be received by the Board of Control until June 12th for the supply of 5,500 feet 3 core paper insulated, lead covered 13,000 volt cable. Specifications are at the office of the engineer, J. G. Glassco, 54 King street.

Wolseley, Sask.

By-laws providing for extensions to the electric lighting plant, sidewalks, etc., will be submitted to the ratepayers [illegible]

CONTRACTS AWARDED

Edmonton, Alta.

The following contracts for telephone cable have been awarded by the city council, to E. F. Phillips Elec. Works, 602 Elec. Rly. Chmbrs., Winnipeg, 103,500 ft. of 25, 50 and 100 pair cable, and to Standard Underground Cable Co., 1002 Elec. Rly. Chmbrs., Winnipeg, 50,400 ft. of 200, 300, 500 and 600 pair cable.

Gananoque, Ont.

The Gananoque Elec. Light Co. has awarded to Mitchell & Wilson the contract for additions to its power plant.

Lojord, Sask.

The contract for the telephone system has been awarded by the Henson & Downing Telephone Co., to Johnson & Foley, Regina.

Leduc, Alta.

The town council has awarded to the Canadian Westinghouse Company a contract for a 50 kw. generator and switchboard equipment, and to the Canadian General Electric Company for all material for approximately 4 miles of pole line.

Medicine Hat, Alta.

Estimates providing for the construction of a large number of gas mains have been completed Engineer, A. K. Grimmer.

Montreal, Que., Outremont

A contract for the supply of street lighting standards has bee awarded by the town council to W. Hamilton Co., 479 Reid St., Peterboro, Ont., as follows, 12 at $57.50 each, and 375 at $36.00 each .

Morse, Sask.

The contract for the construction of a telephone line has been awarded by the Morse Rural Telephone Company to W. D. Craig, of Regina.

New Glasgow, N.S.

Fraser & Chalmers of Canada, Limited, of Montreal, have been awarded a contract by the Nova Scotia Steel & Coal Company, Limited, for a 2,000 kilowatt steam turbine, direct connected to an alternator of Vickers manufacture. Switch gear and the complete condensing apparatus was also included in this order. A 750 kw. mixed pressure turbine of Fraser & Chalmers manufacture was purchased by the Nova Scotia Steel & Coal Company, Limited, about two years ago, and the new unit will be installed in the same building.

Regina, Sask.

The following contracts for supplies have been awarded by the Light & Power Dept. Canadian General Elec. Co., Ltd., 146 Notre Dame Ave., Winnipeg, $3,367.50; Northern Elec. Co., 107 Kerr Block, $3,901.07; Mainer Elec. Co., 61 Albert St., Winnipeg, $537; Can. Equipment & Supply Co., Regina, $4,887.25; Can. Moloney Elec. Co., 901 Elec. Rly. Chmbrs., $10,913.75; Chapman & Walker, 118 Richmond St. W., Toronto, $4,465:

The following sub contracts have been awarded on the power house. General contractors, Wilson & Wilson, Westmann Chmbrs.; steel, Marshall-Wells Co. for 10 tons reinforced steel for floors at $26.16 per M. lbs.

Prince Albert, Sask.

The contract for the erection of the telephone exchange building, has been awarded by the Prov. Govt. Dept. of Telephones to McKay Construction Co., 1818 Scarth St., Regina.

Province of Saskatchewan

The Rural Telephone Companies, Head Office, Osage, have awarded to E. J. Aymond & Deering Elec. Co., of Regina, the contract for the construction of about 90 miles of line.

St. Agathe des Monts, Que.

The contract for hydro-electric development has been awarded by the municipal council to LaCo De Bais et de Constr., Ltd., St. Agathe des Monts.

St. John, N.B.

The contract for the erection of a car barn on Wentworth street has been awarded to A. R. C. Clarke & Son, Water street.

The contract for electric wiring at the boys' industrial home, $1,500, at Courtney Bay, has been secured by Frank Jones, 156 Prince William, St.

Swift Current, Sask.

The following contracts have been awarded in connection with the erection of the power house. General contractors, Gilstrom Contracting Co., W. Cheadle St.; machinery, Canadian Allis-Chalmers Co., Ltd., 146 Notre Dame Ave., Winnipeg.

Walkerville, Ont.

The transforming station contract has been awarded by the Prov. Hydro-electric Commsn., Toronto, to Wells & Gray, Windsor & Toronto.

Windsor, Ont.

The transforming station contract has been awarded by the Prov. Hydro-electric Commsn., Toronto, to H. Christman Co., Hamilton, Ont.

Winnipeg, Man. (Transcona)

The town council has awarded to Jno. H. Kern, Moose Jaw, the contract for the construction of a street car line from Transcona to Winnipeg.

Miscellaneous

Auburn, Ont.

Messrs. Joynt & Todd, are about to purchase special machinery for the manufacture of barrel heads and staves.

Campbellton, N.B.

Quotations for a motor-driven fire pump, about 125 h.p. with motor, are invited by Mr. H. G. V. Farrer, manager of the lighting system.

Edmonton, Alta.

A bylaw providing for fire apparatus, at a cost of $63,753.33, has been passed by the ratepayers.

Ottawa, Ont.

Tenders will be received by L. K. Jones, Dept. Railways and Canals, Ottawa, until 4 p.m. May 5th, for the furnishing hardware supplies to be delivered in such quantities and at such times as may be directed. Specifications are at the office of the Purchasing Agent of above Dept., Ottawa.

Toronto, Ont.

Tenders for wrecking and excavating on Queen W., near Bay St., will be received by E. J. Lennox, architect, 164 Bay St., until May 4th.

Tenders will be received by the Board of Control, until May 12th, for the supply of rubble stone, paving pitch, and drinking fountains. Plans are at the office of the Purchasing Dept., City Hall.

Winnipeg, Man.

Tenders will be received by the Hon. W. H. Montague, Dept. of Public Works, until May 23, for the installation of boilers and stokers in the new power house. Specifications at office of the Architect, F. W. Simon, 261 Fort St.

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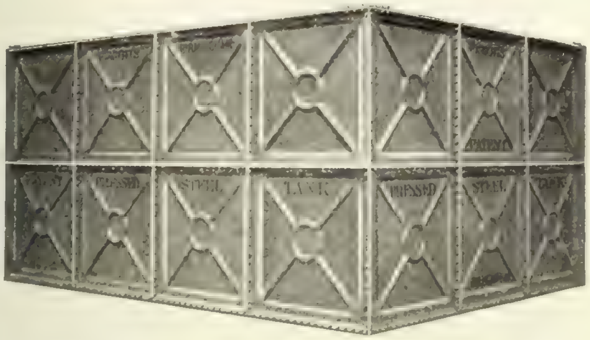

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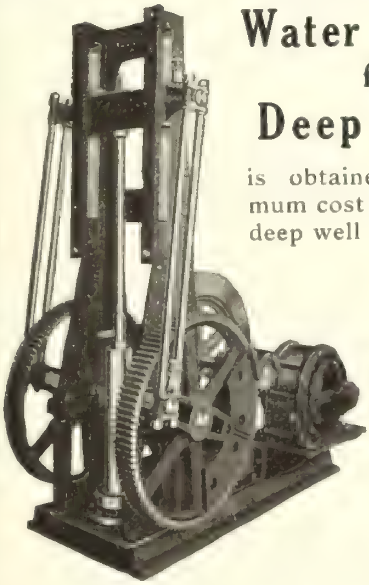

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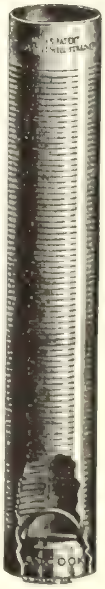

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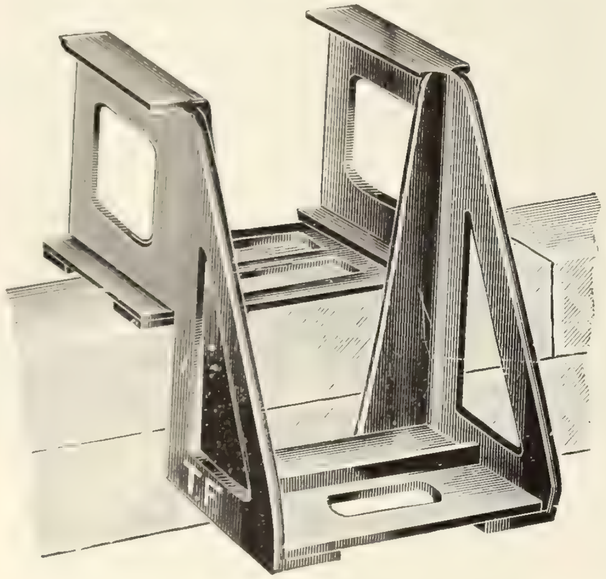

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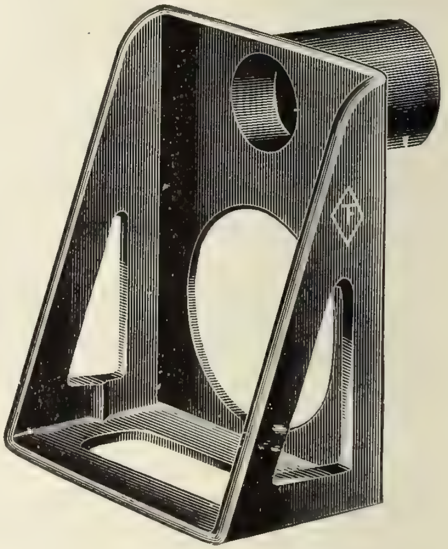

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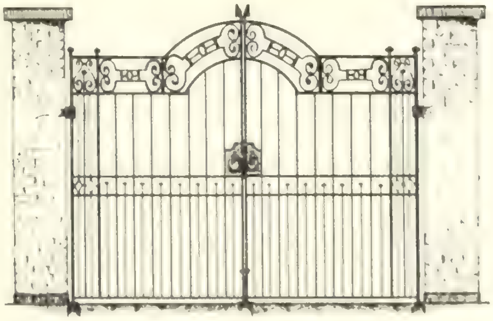

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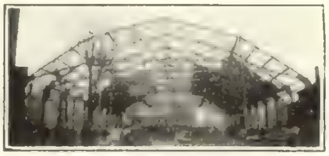

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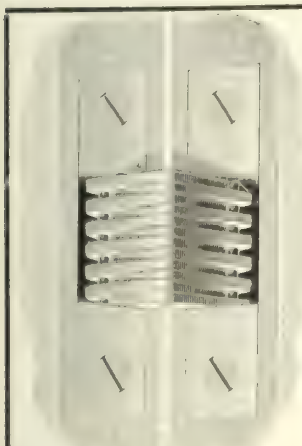

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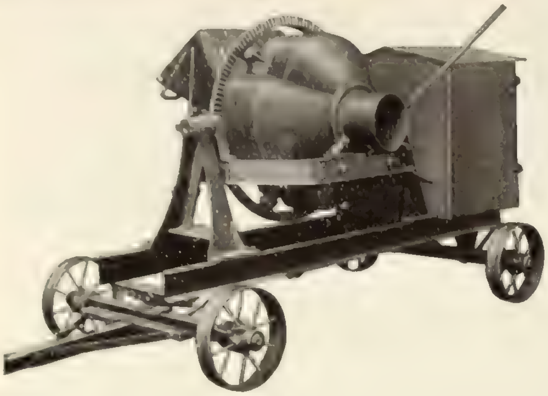

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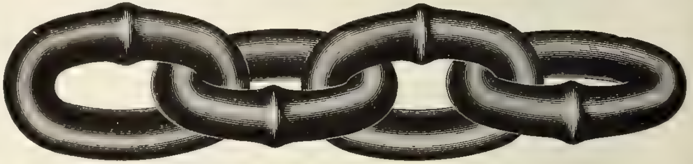

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Proof Test	13,000 lbs.	18,000 lbs.
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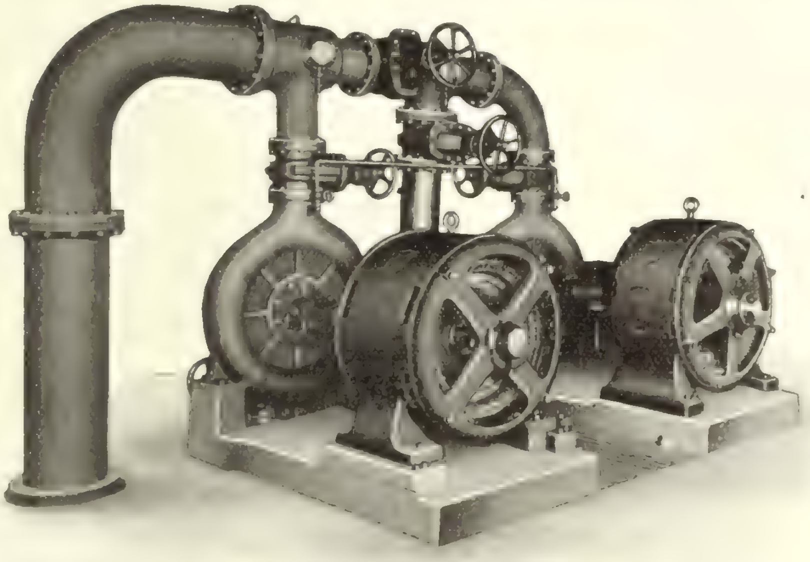

Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

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Works: Seigneurs & William Sts., MONTREAL.

Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants

STANDARD FIRE-PROOF DOORS

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SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
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"INDUSTRY" STEEL PIPES FOR WATER SUPPLY

Seamless or lap welded, mild steel, 2" in diameter and up, long lengths.

Bell and Spigot steel pipes for water or gas.

All pipes are asphalt coated inside and out, wrapped spirally with specially prepared Jute, insuring protection against corrosion, and long life.

SPECIALS for "INDUSTRY" pipes either of steel or cast iron.

We can also supply HIGH PRESSURE steel pipes for

PENSTOCKS, FLUMES, NATURAL GAS, AIR OR OIL.

All of our Steel Pipes are manufactured by the

GELSENKIRCHEN MINING & STEEL CO.

One of the largest steel plants in Germany—employing 50,000 men.
All pipes tested by hydraulic pressure before shipment from the works.

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Boiler Tubes, Superheater and Stay Tubes *Boring Tubes of any description*

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Seamless and Lapwelded

Steel Tubes

Illustration shows a Norwegian pipe line constructed of Mannesmann steel tubes, 60" diameter, highest working pressure 640 lbs. per square inch.

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SEAMLESS STEEL TUBES

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Boilers and Superheaters

Are Specified by the
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Seamless & Lapwelded Steel Spigot Pipe

from
2″ —— to —— 60″
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The Right Quality
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Prompt Deliveries
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The Right Price

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CONDUITS

The Sign of Good Conduit

"Xceladuct" and "Orpenite" Conduit

"Xceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

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Orpen Conduit Manufacturing Co. of Canada
TORONTO, CANADA
Montreal, Quebec

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BRAND
WINDOW
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GLASS
BENDERS
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THE
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THE TORONTO PLATE GLASS IMPORTING COMPANY, LIMITED

Plate, Window, Figured, Stained, Wired, Bent, Mirror
and Ornamental Glass

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TORONTO

The Maritime Bridge
Company, Limited

Successors to

Wm. P. McNeil & Company, Limited

Manufacturers of

Bridges—Steel Buildings
Roof Trusses — Turntables
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Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, **New Glasgow, N. S.**

A STEAM SEPARATOR

of the receiver type is a difficult piece of plate work to make absolutely and permanently tight. That is the reason why we developed our Welded Separator—not a single rivet in its construction, every joint and seam being a perfect weld. The shell is lap welded, the heads are set in by our patented Line Weld method and the necks are attached by our patented Interlock method.

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PITTSBURGH, PA.
ENGINEERS FOUNDERS MACHINISTS
ATWOOD

James Thomson, President. J. G. Allan, Vice-President. James A. Thomson, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

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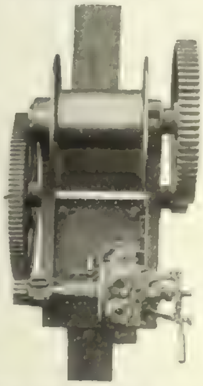
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

The DAKE

HOISTING ENGINES
STEAM CRANE HOISTS
MOTOR CRABS
SWINGING ENGINES

Write for catalog and prices



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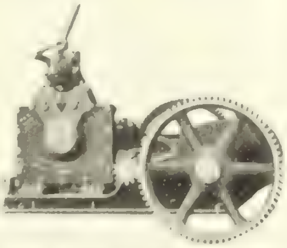

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"Queenston Blue" Limestone

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as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

The Queenston Quarry Co., Ltd.
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Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

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Lime, Sewer Pipe and Fire Brick

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NATIONAL IRON WORKS, Limited

LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments **Offices, Works and Docks, TORONTO**

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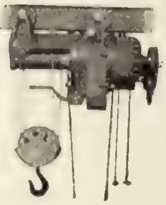

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A few dollars spent in advertising your proposals in

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would result in additional competition, which might save your city or town or your client many hundreds of dollars.

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460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a **HEINICKE.**

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Structural Waterproofing, Engineers and Contractors
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Let Us Tender on Your Roofing, Waterproofing and Flooring Specifications

We supply ROOFING, WATERPROOFING and INSULATING MATERIALS, and undertake contracts for Roofing, Waterproofing, Tar Rock, and Mastic Asphalt Flooring. Our Complete Equipment enables us to execute the work in accordance with Architect's and Engineer's Specifications.

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Manufacturers of the well-known

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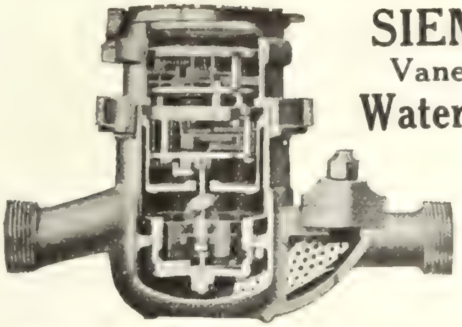

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Vane Wheel
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The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

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TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
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9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
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The Asphalt and Supply Co., Limited
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Towers and Tanks for all purposes.

Concrete Mixers

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Windmills

Water supply outfits of every description.

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"Metallic"

Pressed Zinc Ornaments "Metallic" Made

Our facilities for manufacturing fancy embelishments such as Leaves, Medallions, Brackets, Capitals, Festoons, Garlands, Friezes, Wreaths, Enrichments, Rosettes, Moulding, etc., etc., are of the very best.

Every detail is brought out accurately in bold relief.

An immense variety of Artistic designs is shown in the "Metallic" Catalogue.

If you are interested write to us.

THE METALLIC ROOFING CO.
OF CANADA LIMITED.
TORONTO AND WINNIPEG

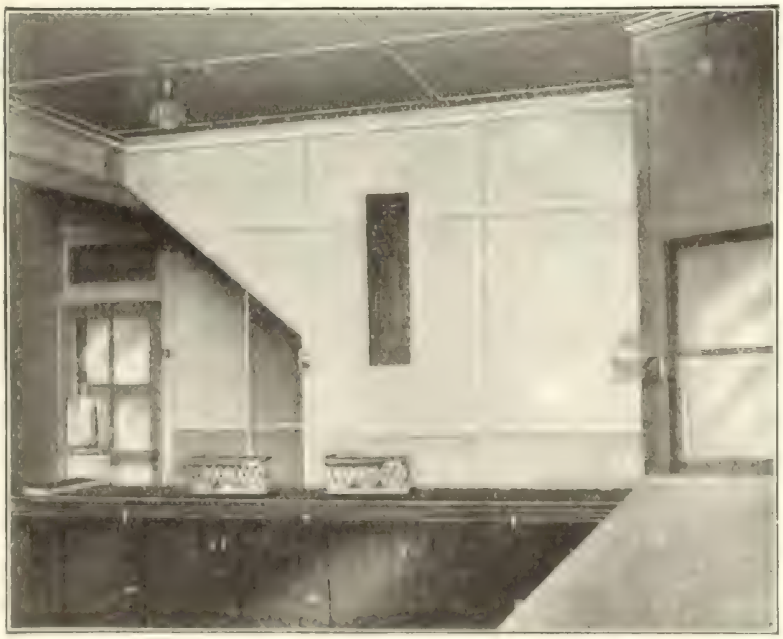
LINABESTOS
Building Board
Makes Fireproof, Sanitary Walls and Ceilings

Don't think of Linabestos as just another building board. It is something entirely different! There is no paper about it—no fibre board—no tar or asphalt compounds. It is made of Portland Cement and Asbestos, in solid, compact sheets 3/16 inch thick, 42 inches wide, and 4 or 8 feet long.

Being absolutely fireproof, Linabestos checks a blaze instead of feeding it.

Linabestos is particularly desirable for kitchens, bathrooms and finished basements, where, with a coat of paint, it gives a perfect sanitary finish—and ceilings that will never crack nor fall. It is well suited, too, for offices, halls and dining rooms, where a panelled finish is most effective.

Write for a sample of Linabestos and Folder 9 giving full information about it.



This view of a part of the Office of Wm. Rutherford & Son Co., Limited, one of Montreal's Leading Lumber Dealers, shows an attractive and absolutely fireproof Linabestos finish. Rutherfords are so well satisfied that they are now selling LINABESTOS.

ASBESTOS MANUFACTURING CO., Limited

Address: E. T. Bank Bldg., 263 St. James St., Montreal — Factory at Lachine, P.Q. (near Montreal

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl.; car lots, $1.55. Bags extra.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red and buff brick, $18; common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick, $8.60; King Edward siding, $7.50 at the yard; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18. Brick 2½ x 4 x 8½ in., blocks 3½ x 4 x 8½ in.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—[illegible] bars, $2.50, base, twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 65c.

MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.35 to $1.50 per bbl., f.o.b. cars, bags 10c; $1.80 l.c.l., bags extra.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—$1 per ton, car loads, on cars.

Gravel—$1.35, f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. Copper bearing sheets—flat, Apollo keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.50 per ton. Plaster of Paris—$2.35 per bbl. Rope—British Manilla, 15c basis per pound; second grade, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 67c per gal. of 9 lbs. Raw linseed oil—in barrels, 64c per gal.

WINNIPEG, MAN.

While business in the building and allied industries in Winnipeg could not, at the present time, be considered as unusually active, there is a very fair volume of work in course of construction, and the demand for building materials is fairly strong. This is particularly true of brick, for which, at time of writing, there is quite a brisk call. A good proportion of constructional work in the vicinity of the city, which includes a considerable number of apartment blocks, is being done in brick, and this has tended to a more active movement in clay products. The local plants which cater to this trade report that they are working to capacity. Lumber is moving fairly freely, though less so than was anticipated. Other materials of construction are, to some extent, ousting timber products in Winnipeg district. The increasing use of brick, concrete and other fireproof materials for building is being felt by local lumber concerns. Structural steel, reinforcing bars and similar materials, are only in fair request. There is a moderate call for cement, crushed stone and gravel, and paints and oils are moving freely. On the whole the situation, from the point of view of the supply houses, is satisfactory without being phenomenally active.

Winnipeg Prices

LUMBER (BUILDING MATERIALS)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100

(Continued on page 106)

Sand, Gravel and Crushed Stone

Lime
Cement
Plaster
Hair
Fire Clay
Fire Brick
Sewer Pipe
Weeping Tile
Building Stone

Our prices are right and our service good.

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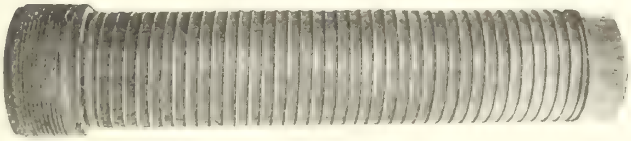
VANCOUVER WOOD PIPE & TANK CO., LTD
(Formerly Municipal Construction Co., Ltd.)



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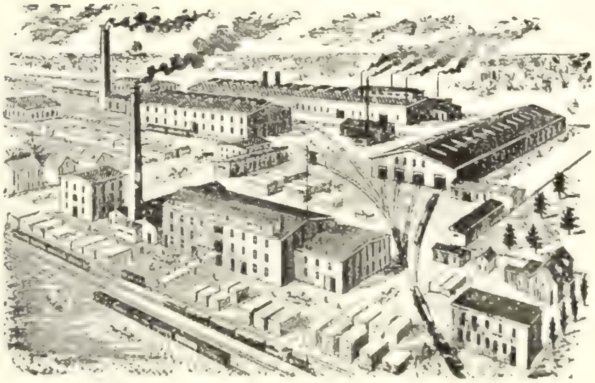

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Cement—Delivered in 5-bbl. lots, $2.60, in car load lots, $2.50.

Lime—[illegible] cents per bushel; white, 32 cents, 2 [illegible] per bushel in lots not less than 1,000 lbs.

Brick—No. 1 [illegible] pressed, red and buff, $30 to $40 [illegible] stock, $25; common grey stock, $12; No. 1 enamelled brick, all col[illegible] $110; sandlime, $12.

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.80 per cu. yd.

Gravel—Per yd., delivered, $1.90.

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

Paints and Oils—White lead, ground in oil, $8.80 per 100 lbs.; boiled liseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.80 per bbl.; putty in 25-lb. tins, $3.20; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

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Gravel—$1.40 per yard delivered.

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Galvanized iron—28 gauge, $4.85 per 100 lbs.

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Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

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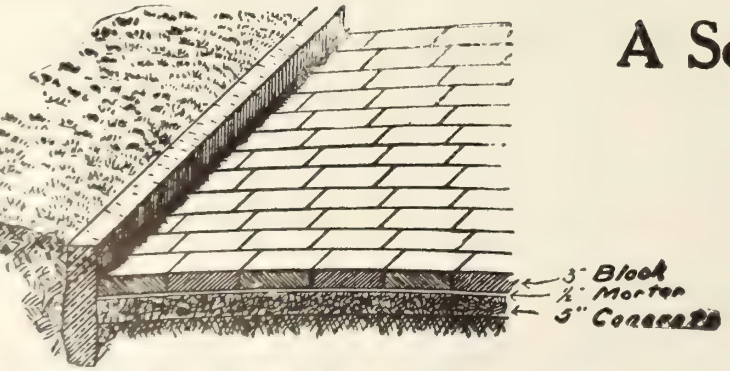

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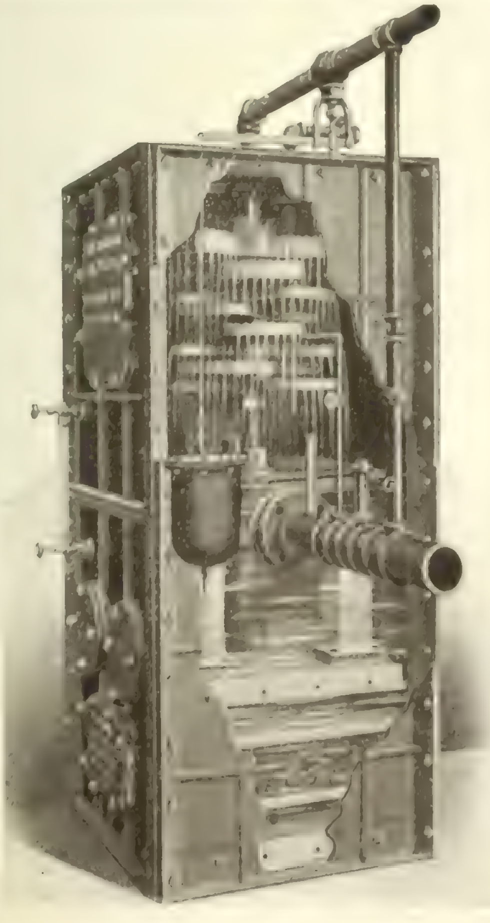

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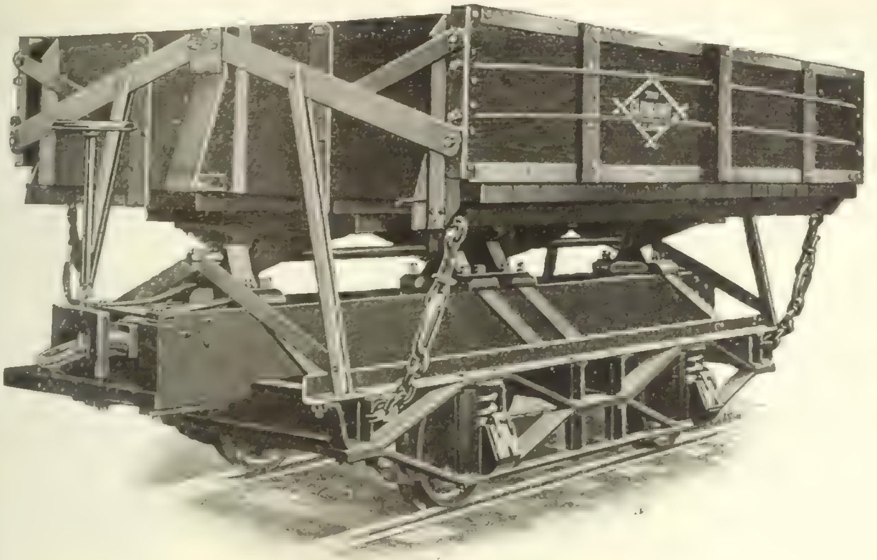

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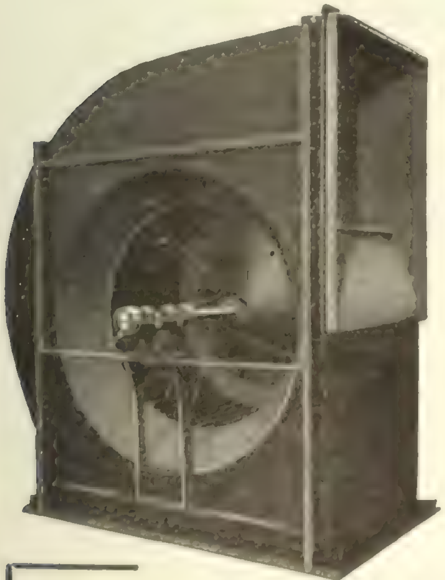

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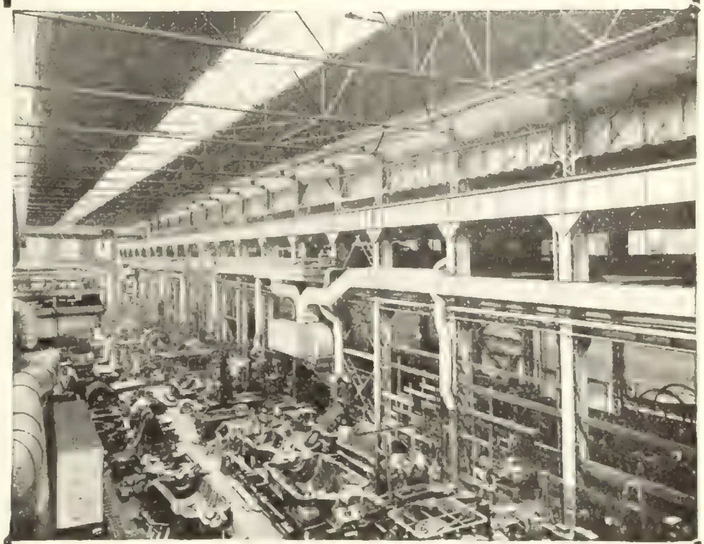

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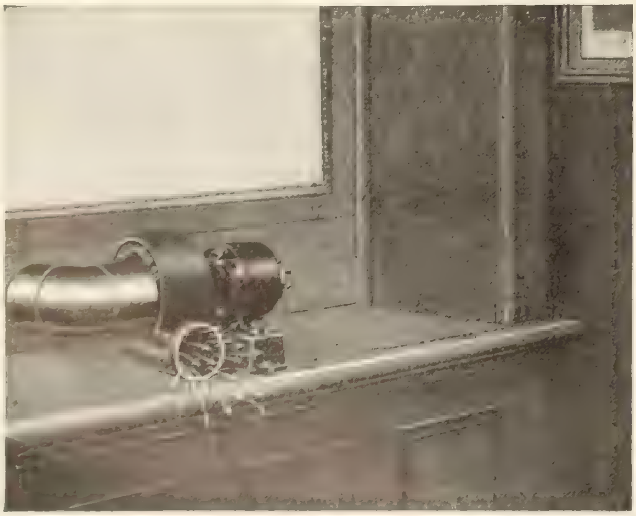

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Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price $1.50.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price $1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

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Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

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Sackville Freestone Co., Limited, Sackville, N. B.

WRITE US FOR QUOTATIONS

Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Fourth of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

Electric Railway Chambers Winnipeg

This building was wired with

"Imperial Higrade" Rubber Insulated Wire

Architect: Pratt & Ross, Winnipeg.
Engineers: Neiler, Rich Co., Chicago.
Electrical Contractors: Schumacher Gray Co. Winnipeg.

Address our nearest office

Northern Electric Company
LIMITED

Montreal
Halifax
Toronto
Winnipeg
Regina
Calgary
Edmonton
Vancouver
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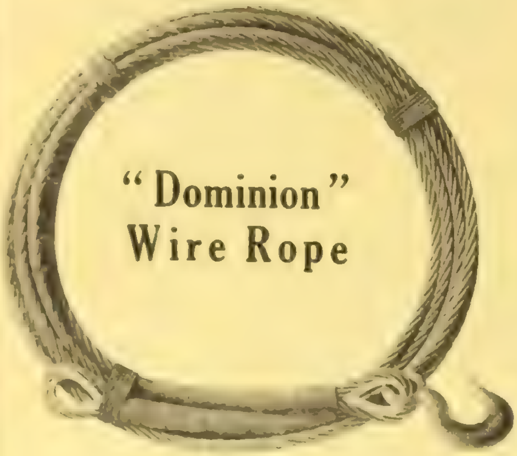
Successors to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C.P.R. Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.



WIRE ROPE

Suitable for any requirement

We carry in stock all sizes and lengths wire rope for

Hoisting, Haulage, Guys, Semaphores, Transmission of Power, Towing, Bridges, Mines, Derricks, Cranes, Cableways, Coal Towers, Etc.

We manufacture special ropes to take care of your particular needs.

WIRE ROPE FITTINGS, BLOCKS, CLIPS, ETC. IN STOCK

The Dominion WIRE ROPE Co. Ltd.

MONTREAL

"Industrial Works"

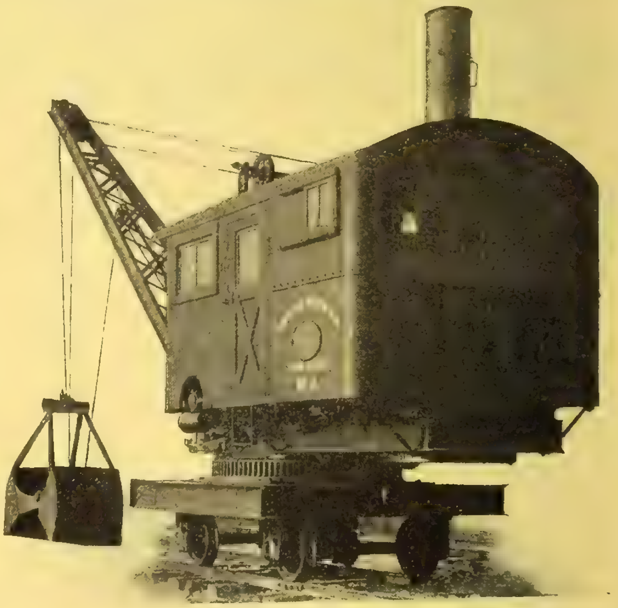
Locomotive-Coaling and Wrecking

CRANES

In capacities from

5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.



BUCKETS

For Every Purpose

We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO.,

HEAD OFFICE
MONTREAL

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, May 27, 1914 No. 21

ESTABLISHED 1886

Contract Record and Engineering Review

Why Not Buy The Best

when in the market for

PUMPING MACHINERY?

Stock of pumps carried by
General Supply Co. of Canada,
Winnipeg, Man.

The Smart-Turner Machine Co., Ltd.
HAMILTON, ONT.

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

THE "JACKHAMER"

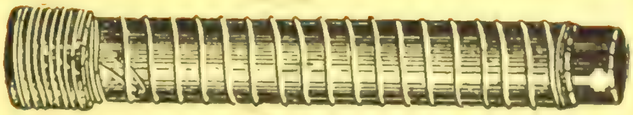
For Shaft Sinking, Quarrying, Open Cut and Trench Work.

Catalogue K68 Describes it.

Canadian Ingersoll-Rand Co., Limited
MONTREAL, CAN.

A "One-Man Drill"

operated by steam or air. Automatic in rotation and lubrication. All-Steel in construction.



Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

"Announcement"

In addition to a full line of other types of crushing machinery and equipment we are now building

Gyratory Crushers

of most modern design and equipped with an improved

Water Cooled Eccentric Bearing

Made in all sizes for all capacities and for crushing any kind of material.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catherines Toronto Montreal Cobalt South Porcupine
Vancouver and Nelson

One man takes a chance, that's gambling; another buys "AMERICAN" Steel Derricks, that's good business, which is nothing but sound common sense.

Every possible stress and strain is covered by the carefully calculated and proportioned construction of these derricks.

An "AMERICAN"
Fifty-Ton Steel Guy Derrick

is shown here working on the Hardaway Contracting Company's big hydro-electric power construction at Whitney, N.C. It is lifting a 96,000 pound casting of a Gates crusher. This derrick has a monster 5 sheave block—as tall as a man.

Greatest safety, longest service—You get them both when you buy "AMERICAN" Steel Derricks.

MADE BY

American Hoist & Derrick Company

ST. PAUL, MINN., U. S. A.

SOLD BY

General Supply Co. of Canada, Ltd., Montreal, Ottawa, Toronto. Stuart Machinery Co., Winnipeg, Man.
Vancouver Machinery Depot, Ltd., Vancouver, B. C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

Administration Building, Washington Park, Chicago,—Reinforced Concrete.

Aesthetic Treatment of Concrete Buildings

It frequently happens that Architects or Engineers are called upon to design buildings—such as libraries, museums, club houses, park buildings, etc., in which one of the principal features is an artistic exterior. In cases of this kind no material lends itself to greater variety of treatment than does concrete. It can be moulded to any desired form and the surface given any one of a number of different and attractive kinds of finish.

A Striking Example

The building shown above has an exterior entirely of concrete. Every detail and decoration is made of this material. Not only may concrete be used for decorative purposes but combined with this important feature is its great strength and durability.

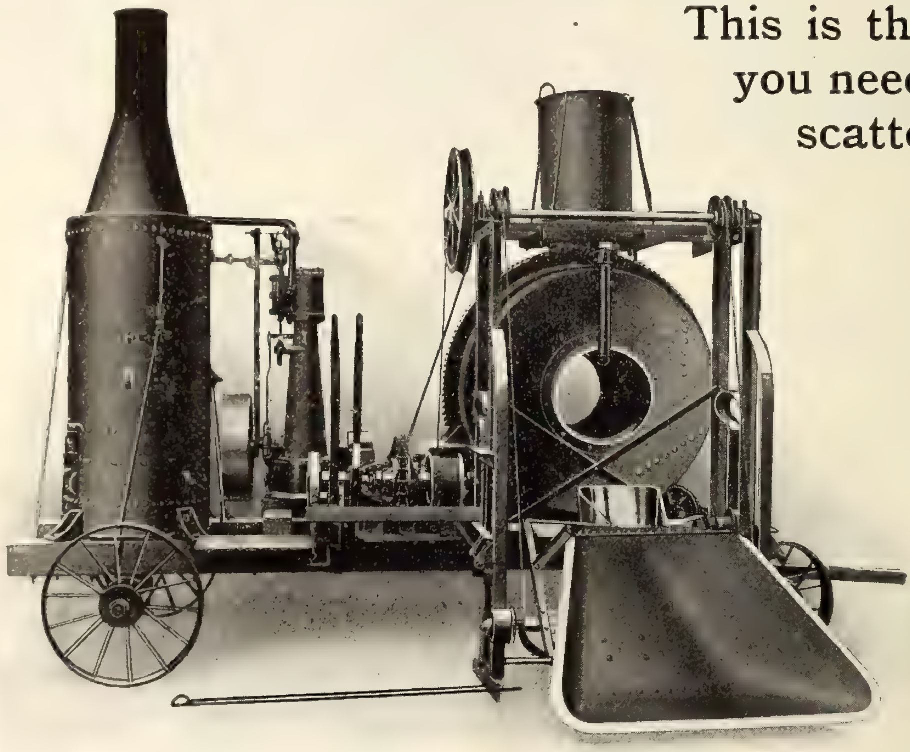
Architects, Engineers and Contractors, engaged in this class of work can obtain many useful suggestions for the artistic treatment of buildings as a whole and in detail by simply addressing their requests to

Canada Cement Company
Limited

887 Herald Building, Montreal

Latest Model
of the
Chicago Concrete Mixer
with side loader

This is the machine
you need for your
scattered jobs.



Portable, Light, Strong—Built in three sizes—
Any mounting—Steam or gasoline.

Made in Montreal under our own supervision.

Shipment from stock.

Mussens Limited

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TORONTO, 155 West Richmond St.
COBALT Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.

QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

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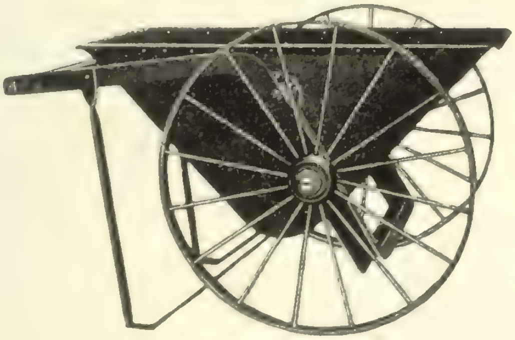
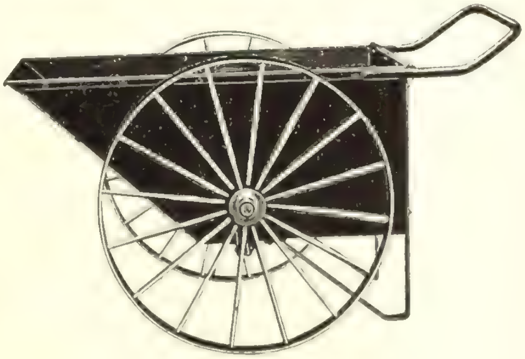


and

BARROWS

in all styles

Contractors'
Barrows
for all
Purposes



Factory, Warehouse
and Railway Trucks

*Send for new catalogue
on barrows and carts.*

Mussens Limited

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ST. JOHN, N. B., 57 Smythe St.
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The following regulations apply to all advertisers:—Eighth page, two headings quarter page, four headings; half page, eight headings; full page, sixteen headings.

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Hull Iron & Steel Foundries

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British Mfrs. Assn. of Canada.
Canadian Allis Chalmers, Limited
Canadian Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Jenckes Machine Company

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Architects' Instruments
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Canadian Allis-Chalmers, Limited
Canada Wire & Iron Goods Co.
Dennis Wire & Iron Works
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Badger Concrete Mixer Co.
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Canadian Ingersoll-Rand Co.

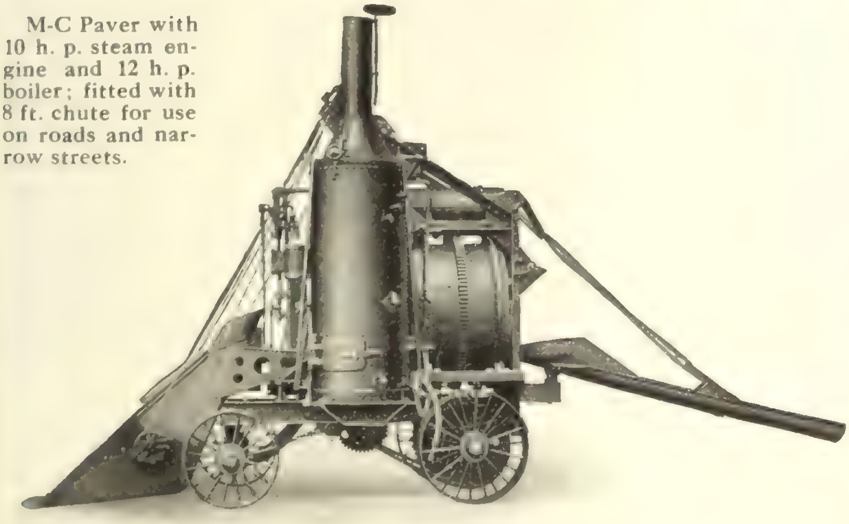
(Continued on page 10)

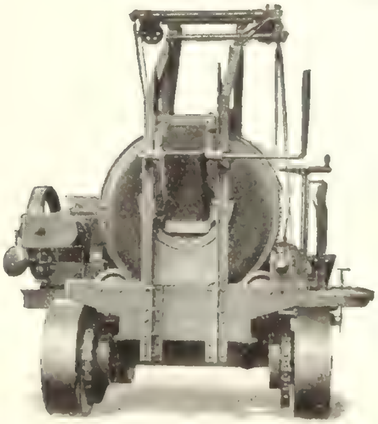
Best and Biggest Service

assured every contractor who uses an

M-C Rail-Track Paver

M-C Paver with 10 h. p. steam engine and 12 h. p. boiler; fitted with 8 ft. chute for use on roads and narrow streets.





Fitted with 12 h. p. gasoline engine
Arranged to discharge into two-wheeled carts.

What the M-C Paver Will Do

The mixer drum will hold 11 cubic feet of wet mixed concrete or about 16 cubic feet of unmixed sand, stone and cement per batch. It will mix a two bag batch of 1-3-5 concrete without spilling.

It will discharge into carts when machine is set up at intersection of city streets. When fitted with delivery chute, it will most economically lay concrete for roads or narrow streets.

When fitted with 16 ft. delivery trough with mixing conveyor, it can't be excelled for laying base for wide pavements. Working on the low gear when traveling, it will pull itself out of trouble on bad roads or climb hills in a way that is impossible in a machine that is higher geared or has less power.

When traveling on the high gear it will make better time in going from job to job than is possible with lower geared machines.

Because of the brakes, it is always under control when going down hill.

One man only required to operate it and not hard work for him. Every lever placed at comfortable position—no stretching or back-breaking work.

No other paver manufactured will do as much work or stand as much wear as the M-C Rail-Track Paver

Write today for full information—Address nearest agent.

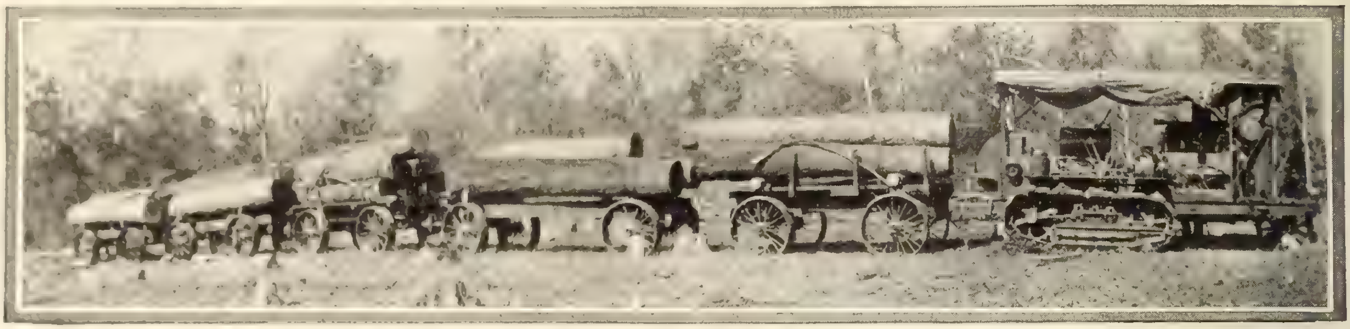
CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company

465 Old Colony Bldg., CHICAGO



A Letter From Mr. Quereaux of Texas

"I have just returned from the most wonderful demonstration of a Hauling Outfit that I have ever witnessed, or, I believe, has ever been undertaken. The five Troy Reversible Trucks sold to Mr. Cox, of this city, arrived here Wednesday.

"We had them on the ground and coupled together at eleven P.M. Thursday night. Early Friday morning we loaded them with supplies for the commissary, 6 tons of gasoline in steel drums, a complete saw-mill—a big one at that—a hundred sacks of oats and things too numerous to mention, in all a total tonnage, as near as I could estimate, of 32 tons. The first mile of Palestine streets was fairly good and when we started it seemed as if all the inhabitants of Palestine and surrounding country were there. Really, it attracted as much attention as a circus would. The streets were narrow and before leaving town we made two right angle turns and the manner in which the train followed in track around these corners attracted considerable attention and caused one old man to remark: 'How did you learn 'em?' The first twelve miles of road was deep sand and somewhat hilly, but the 10-in. tires carried the load very nicely and we went along with scarcely any trouble. Only once was it necessary to cut the train apart, and then it was more the fault of a new fill that was extremely soft and it would have been possible to have gone over this had I zigzagged the wheels to cover more surface of this soft roadway. We left the road entirely and began another twelve miles of winding through swamps, marshes and virgin forest, in some places a mere path winding in and out of the trees. A bunch of nigger axe men went ahead and cut out trees, stumps and rolled logs out of the way, making the road as passable as possible. At first we watched the wagon train very carefully for fear it would cut the corners and run against the stumps or trees, but we found this unnecessary, for no matter how severe the angle or narrow the trail, the wagons followed in track of the tractor. We forded streams and crawled up banks four and five feet high, went over places that it would be almost impossible for a team to carry an ordinary load, and in some places it was necessary to hew two inches off the sides of trees in order to let the tractor through.

"The wagons followed along and simply took care of themselves. It was a hard trip and for two nights we slept on the ground with a fire at our backs and a sack of oats for a pillow. Our grub ran out Saturday afternoon, but we were fortunate enough to strike a nigger nester's shack Sunday morning where we got a "snack" which lasted us until we reached camp Sunday afternoon. I feel well repaid for making this trip, for one has to "see to believe" and this has been to me a most valuable experience in the hauling game, and I know that there is no freighting proposition or road condition that TROYS will not negotiate successfully."

Get our Hauling Book 2 R—this is only one of over two-hundred and fifty (250) successful Troy Trains. If it's a big job you need reversibles.

The Troy Wagon Works Co., N. Market Street, Troy, Miami County, Ohio

Main Street, Wheeling, W. Va.

Judge By Actual Results

PAVING BRICKS all look more or less alike. But their wearing qualities—that's a different matter. Then you can judge only by actual service. The busy street shown above is paved with

BESSEMER
Wire-Cut-Lug Paving Blocks

It has given eminently satisfactory service under hard, heavy usage for many years and it will continue to do so for many years to come.

The highest quality of shale, modern factory methods and skilled handling produce in Bessemer Block the ideal road-paving material. Dustless and mudless roads are made possible with Bessemer Block. They are tough, strong, durable and uniform.

Full information gladly furnished on request.

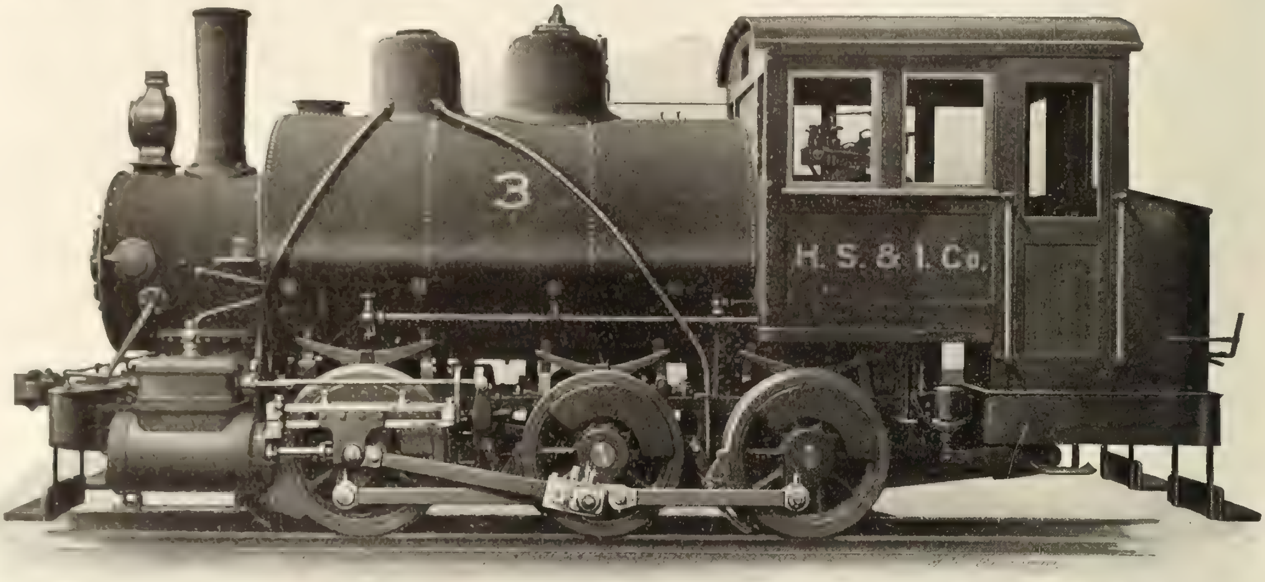
Bessemer Limestone Company

Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Blocks

Youngstown, Ohio

Canadian Agents { G. W. ESSERY, 47 Yonge Street, Arcade Building, Toronto, Ontario
STINSON-REEB BUILDERS SUPPLY CO. Montreal, Quebec.

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builder Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.
We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA
TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

VITREOUS FACE BRICK

OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names in Mind when Ordering High Grade Brick.

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Columbus Brick and Terra Cotta Co.
Hydraulic-Press Brick Co.
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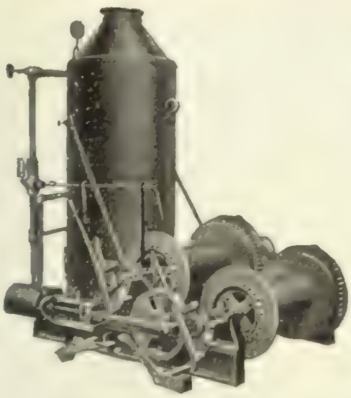
Pearl Clay Products Co.
Tiffany Enameled Brick Co.

BLACK BUILDING SUPPLY CO., LTD. - TORONTO



Standard Hoisting Engine

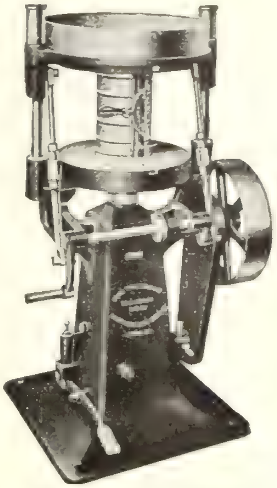
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur, Ont.—Northern Agency Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

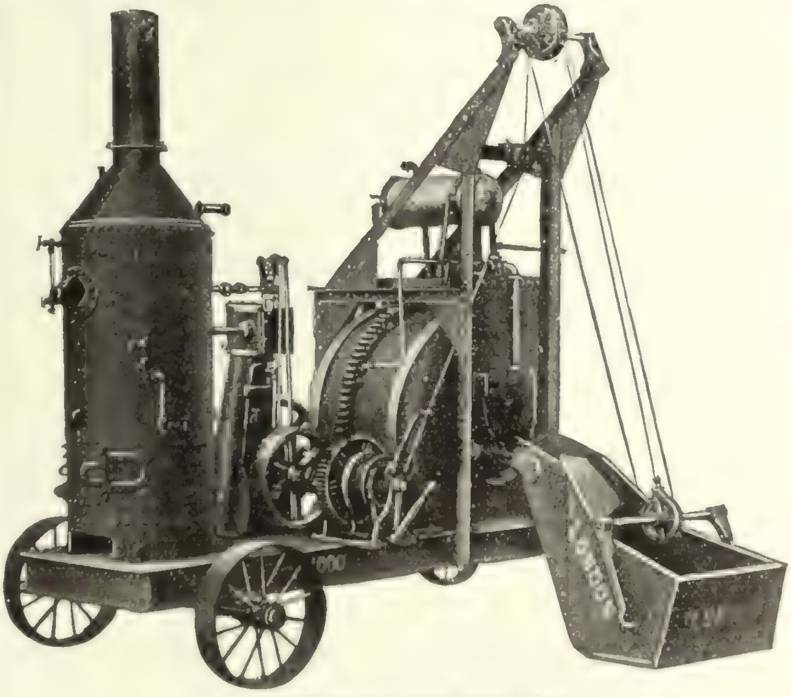
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

—

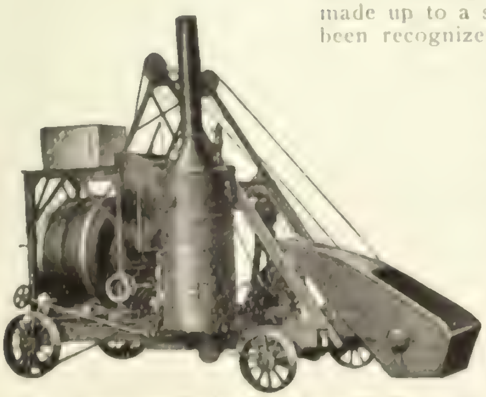
Pumping Outfits

—

Hoists and Derricks

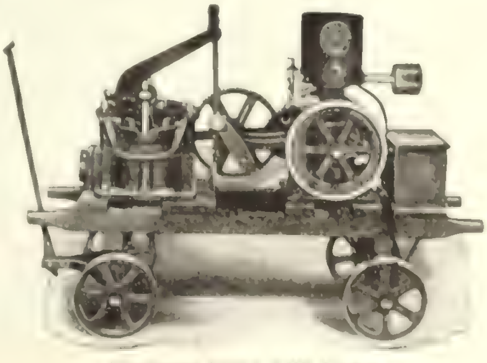
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader

Correspondence Solicited.



Diaphram Pump with Tower

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Drop Forgings
  Canadian Billings & Spencer, Ltd

Dump Cars, Wheels, etc.
  [illegible] Limited
  Manitoba Bridge & Iron Works
  [illegible] Foundry & Machine Co
  Western Wheeled Scraper Co
  Weller Mfg. Co.
  Sheldons Limited

Dump Carts and Wagons
  Deere Plow Co., John.
  [illegible] Wagon Works

Drying Apparatus
  Sturtevant Co. of Can. Ltd. B. F.

Electric Fans
  Sturtevant Co. of Can. Ltd. B. F.

Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electric Steel Castings
  Electric Steel & Metals Co.

Elevators
  Roelofson Elevator Works.

Enamelled Brick
  American Enamelled Brick & Tile Company
  National Builders' Supply & Enamel Concrete Brick Co.

Engines
  Boving Company of Canada
  Canadian Buffalo Forge Co.
  Canadian Sirocco Co.
  Inglis Co., John
  Jenckes Machine Co.
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks
  Mussens Limited
  Rock & Power Machinery
  Waterous Engine Works Co.
  Wettlaufer Bros.

Engineers (Civil and Mechanical)
  Laird Murray & Lowes
  Bowman & Connor
  Campbell, R.
  Chipman & Power
  Dominion Engineering & Inspection Company.
  Farmer, John T.
  Galt Engineering Co., John
  Lea & Ferguson
  Mitchell, C. H.
  Thorold Co., F. W.
  Tyrrell, H. G.

Excavators
  Austin Drainage Excavator Company, F. C.
  Brown Hoisting Machinery Co.
  Municipal Engineering & Contracting Company.
  Parsons Company, G. W.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Expansion Bolts
  Star Expansion Bolt Co.

Expanded Metal
  Mannesmann Tube Co.
  Pedlar People Limited.

Fans
  Canadian Sirocco Co.
  Sheldons Limited.
  Sturtevant Co. of Can. Ltd. B. F.

Fuel Economizers
  Sturtevant Co. of Can. Ltd. B. F.

Electrical Machinery and Supplies
  Ferranti Electrical Co.
  Sturtevant Co. of Can. Ltd. B. F.

Field Instruments
  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Fire Brick
  Elk Fire Brick Co.
  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works.
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry.
  Mussens Limited
  Pedlar People Limited.
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Fixtures (Gas)
  Consumers Gas Co.

Floor and Wall Tile
  Frontenac Floor & Wall Tile Co.

Folding Doors
  Springer, O. T.

Forges
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

Gas Engines
  Armstrong Mfg. Co.
  British Mfrs. Assn. of Canada.

Gasoline Engines
  Armstrong Mfg. Co.
  Mills Bros.
  Original Gas Engine Co.
  Wettlaufer Bros.

Glass
  Consolidated Glass Co.
  Excelsior Plate Glass Co.
  Hobbs Mfg. Co.
  Luxfer Prism Co.
  Pilkington Bros.
  Toronto Plate Glass Imp't'g Co.

Gravel Washing Plants
  Dull Co., Raymond W.

Hammer Drills
  Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Escher Wyss & Co.
  Mannesmann Tube Company.
  Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Fairbanks-Morse Co.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
  Marsh & Henthorn
  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Rock & Power Machinery
  Royce Limited
  Sturtevant Co. of Can. Ltd., B. F.

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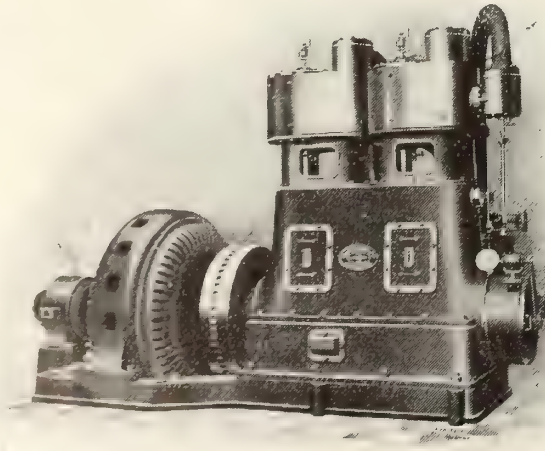
BRUCE PEEBLES



Peebles-Browett Alternator Set

Alternators and Generators

are built suitable for belt-drive or for direct coupling to any form of prime mover.

Send Us Your Enquiries

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

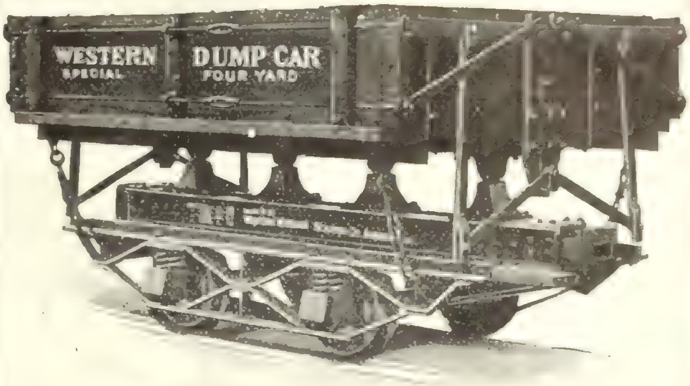
Farmers' Advocate Building,
Cor. Notre Dame & Langside,
WINNIPEG

If you are not using

"ABRAM" TOOLS

It is plain to be seen
you are
losing money

Abram Cement Tool Co.,
Windsor, Ontario



The Western Four-Yard Car

by reason of its strength at every point of resistance, is beyond competition.

The sterling qualities of the Western Standard 4-yard Car are responsible for its high standing with men engaged in the handling of earth and stone. Many thousands of these cars have been sold and are used on the most important earth moving projects of the age.

The Western Special 4-yard Car, our most recent product, is designed for even harder service than the Standard Car, and we urge those desirous of securing cars of great strength to make a careful examination of this car.

Western Wheeled Scraper Co.

AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built
of a

Tough Stone

that
will cement

WE HAVE IT

The Hagersville Contracting Company, Limited

Hagersville - Ont.

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Heating Apparatus
Canadian Buffalo Forge Co
Canadian Sirocco Co
Sheldons Limited

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Northern Crane Works.
Stratford Mfg. Company

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

Industrial Cars
Central Locomotive & Car Works

Insulating Compounds
Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
Batts Limited
Canada Office & School Fur. Co.
Rhodes Curry & Co.

Jib Cranes (all kinds)
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

Kilns
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
Canadian Sirocco Co.
Berg Machinery Mfg. Co.

Lime
Dominion Lime Company.
Jamieson Lime Co.
Ontario Lime Co., Ltd.
Standard White Lime Co.

Lighting and Pumping Installations
Lister & Co., Ltd., R. A.

Locks
Can. Yale & Towne Ltd.

Locomotives
Boving Company of Canada
Central Locomotive & Car Works
Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Co.
Mussens Limited

Metal (Anti-Corrosive)
Stark Rolling Mill Co.

Metal Lath
Greening Wire Co., B.
Metallic Roofing Co.
Noble, C. W.
Pedlar People Limited.
Steel & Radiation Ltd

Meters, Electrical
Siemens Co. of Canada, Ltd.
Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd.

Mechanical Draft Apparatus
Sturtevant Co. of Can. Ltd. B. F.

Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
Neptune Meter Co.
Siemens Co. of Canada, Ltd.

Overhead Runways
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

Paints and Varnishes
Dominion Paint Works
Hopkins & Co., F. H.

Paving and Paving Materials
Asphalt & Supply Co.
Aztec Oil Asphalt Co
Bessemer Limestone Co.
Baker Co., R. D.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Dunn Wire-Cut-Lug Brick Co.
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

Pipe (Concrete, Iron and Wood)
American Spiral Pipe Works
Canadian Allis-Chalmers, Ltd.
Canadian Pipe Co.
Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
Gerald Lomer, Ltd.
Mannesmann Tube Company.
National Concrete Mfg. Co.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
Steffens & Nolle
United States Cast Iron Pipe Co
Vancouver Wood Pipe & Tank Company.
Walsh Plate & Structural Works.

Partition Hangers
Springer, O. T.

Paints (Bridge and Structural Iron and Pipe Coating)
Dominion Paint Works

Perforated Metals
Canada Wire & Iron Goods Co.
Greening Wire Co., B.

Pipe Machinery
Sutcliffe, Speakman & Co.

Pile Driving Machinery
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Pipe Fittings and Flanges
Pittsburgh Valve, Foundry & Construction Company

Plumbing Supplies
Mueller Mfg. Co., H.

Planing Mill Exhausters
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.

Plaster
Alabastine Hardmortar Co.
Albert Mfg. Company
Britnell & Company
Ontario Lime Co., Ltd.

Plate Glass
Excelsior Plate Glass Co.
Pilkington Bros.

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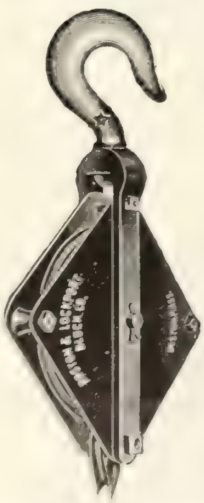
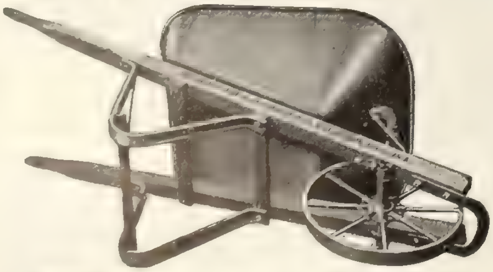

BROWN & LOCKHART MDSE CO.



Right Goods at
Right Prices

Contractors' Tools, like all other engineering supplies when bought right, are bought on an efficiency basis. It is not a question of cheapness but one of "will they give me the greatest value for my money?" "Are they durable and are they designed right to get the most work out of my men?"

Our line of Contractors' Supplies is carefully selected to meet every demand made upon them.

Among others, we carry a full stock of M-C Rail Track Concrete Mixers, Barrett Jacks, K. & J. Wheelbarrows, Star Dump Wagons, Tackle Blocks, Hoisting Engines, Tools, etc..

The Canadian Fairbanks-Morse Co., Limited

Montreal Toronto
Quebec Ottawa
St. John Hamilton
Ft. William
Winnipeg Calgary
Regina Edmonton
Saskatoon Vancouver
Victoria

Canada's Departmental House for Mechanical Goods

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

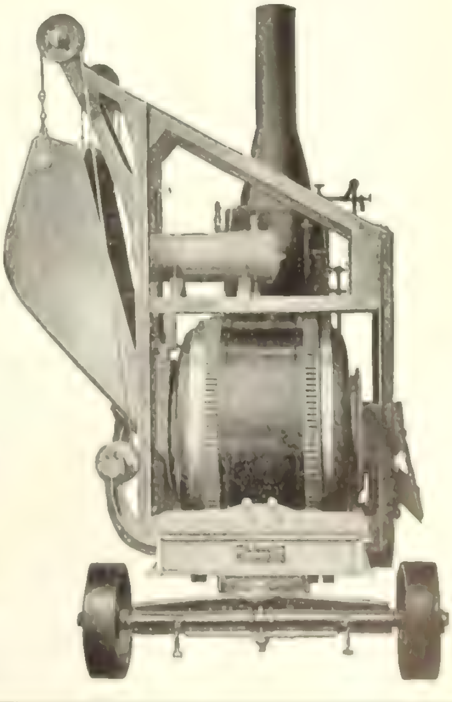
Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.



KOEHRING MACHINE CO.

Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

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Plumbing
Dietrich Limited

Pneumatic Machinery
Canadian Ingersoll Rand Co

Pumps and Pumping Machinery
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Boving Company of Canada
British Mfrs. Assn. of Canada
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
Cook, A. D.
Gray Mfg. & Machine Co.
Hamilton Mfg. Co., Wm.
Hoerig & Mock.
Inglis & Company, John
McDougall Caledonian Iron Wks
Morris Machine Works.
Smart Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Rock & Power Machinery
Wettlaufer Bros.

Portable Saws
Canadian Fairbanks-Morse Co.

Portable Track
Bechtels Limited

Pulleys
Sutcliffe, Speakman & Co.

Plug Drillers
Canadian Ingersoll-Rand Co.

Power Engines
Inglis Company, John
Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.
Waterous Engine Works

Quarry Machinery
Canadian Allis-Chalmers, Ltd.
Canadian Ingersoll-Rand Co.
Improved Equipment Co.
Lecky & Collis
George Anderson & Co.
Goodwin, Barsby & Company.
Rock & Power Machinery, Ltd.

Railway Supplies
Gartshore, John J.
Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

Reinforcements, Concrete & Stee
Brown Hoisting Machinery Co.
Burlington Steel Company
Canada Wire & Iron Goods Co.
Dominion Iron & Steel Co.
Greening Wire Co., B.
Pedlar People Limited.
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
Turner, C. A. P.

Radial Brick Chimneys
H. R. Heinicke Inc

Refrigeration Machinery
Equipment & Supplies, Limited.

Road Asphalt
Asphalt & Supply Co.
Barber Asphalt Paving Co.

Road Machinery
Dore & Fils
Exeter Mfg. Co., Ltd.
General Car & Mach. Works
Lecky & Collis
Morrison & Co., T. A.
Mussens Limited
Waterous Engine Works Co.
Western Wheeled Scraper Co.

Revolving Stone Screens
Goodwin, Barsby & Company.
Greening Wire Co., B.

Roof Glazing
Hope & Sons, Henry.

Roofing Material
Asbestos Mfg. Company
Barber Asphalt Paving Co.
Bird & Son
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.
Pedlar People Limited.

Rubber Belting
Canadian Fairbanks-Morse Co.

Safes and Vaults
Taylor, J. & J.

Sand and Gravel
Ontario Lime Co., Ltd.
Sand and Supplies Limited
York Sand and Gravel Co.

Screens
Canada Wire & Iron Goods Co.
Goodwin, Barsby & Company.
Greening Wire Mfg. Co., B.
Weller Mfg. Co.

Sewerage Ejectors
British Mfrs. Assn. of Canada.

Sewer Pipe
Britnell & Company
Canada Iron Corporation
Canadian Sewer Pipe Co.
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
Hamilton & Toronto Sewer Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sewer Trenching
Lecky & Collis

Shovels (Steam)
Browning Co.
Beatty & Sons, M.
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Montreal Locomotive Works
Mussens Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co.

Skylights
Hope & Sons, Henry

Smoke Stacks
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Hamilton Mfg. Co., Wm.
Manitoba Bridge & Iron Works.
Pittsburgh-DesMoines Steel Co.
Walsh Plate & Structural Works

Steam Apparatus and Specialties
Canadian Buffalo Forge Co.
Pittsburgh Valve, Foundry and Construction Company
Sheldons Limited

Steel Doors
Gray Mfg. & Machine Co.

Steel Trucks
Gray Mfg. & Machine Co.

Steam Engines
Sturtevant Co. of Can. Ltd. B. F.

Steam Turbines
British Mfrs. Assn. of Canada.
Canadian Allis-Chalmers, Ltd.
McDougall Caledonian Iron Wks.
Sturtevant Co. of Can. Ltd. B. F.

Steel Bars
Dominion Iron & Steel Co.
Steel & Radiation, Ltd.

Steel
Burlington Steel Company
Can. Billings & Spencer
Lecky & Collis

Steel Pipe
Gerald Lomer, Limited
Mannesmann Tube Company.
Page-Hersey Iron Tube & Lead Co., Ltd.
Steffens & Nolle

Steel Tubes
Mannesmann Tube Co.

Sound Deadening
Cabot, Inc., Samuel

Stains, Shingle, Cement & Brick
Cabot, Inc., Samuel

Stair Builders
McGregor & McIntyre

Steel Castings
Electric Steel & Metals Co.

Steel Sash
Hope & Sons, Henry.

Steel Sheet Piling
Drury Company, H. A.

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Britnell & Company
Brodie, James
Consolidated Stone Company
Contractors' Supply Company
Crushed Stone, Limited
Elbram Stone Co.
Hagersville Contracting Co.
Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Parsons Company, G. W.
Queenstown Quarry Co.
Rogers Supply Company
Sackville Freestone Company
Sand & Supplies
Smyth & Ryan

Stone Saws
Anderson, Geo.

Store Fronts
Zouri Drawn Metals Co.

Structural Iron and Steel
Burlington Steel Company
Canadian Allis-Chalmers, Ltd.
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Dominion Bridge Company
Drury Company, H. A.
Hamilton Bridge Works Co.
Mackinnon Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
McGregor & McIntyre
Pittsburgh-DesMoines Steel Co.
Reid & Brown
Sarnia Bridge Company
Structural Steel Company
Standard Steel Construction Co.
Toronto Structural Steel Co.
Walsh Plate & Structural Works

Submarine Drills
Lecky & Collis

Swinging Gears
Dake Engine Company

Tanks and Stand Pipes
Chicago Bridge & Iron Works
Hamilton Mfg. Co., Wm.
Inglis, John
Jenckes Machine Co.
Manitoba Bridge & Iron Works.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
Ontario Wind Eng. & Pump Co.
Piggott & Co., Thos.
Pittsburgh-DesMoines Steel Co.
Vancouver Wood Pipe & Tank Company.
Walsh Plate and Structural Wks.
Waterous Engine Works Co.

Terra Cotta
Northwestern Terra Cotta Co.

Testing and Inspecting Bureau
Hunt & Co., Robt. W.

Tile Machinery
Sutcliffe, Speakman & Co.

Track Systems (Hand, Power and Electric)
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

Traction and Lighting Poles
Mannesmann Tube. Co.

Turnbuckles
Canadian Billings & Spencer, Ltd.

Underground Conduit
Dietrich Limited

Valves
Canadian Allis-Chalmers, Ltd.
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Golden Anderson Valve Co.
Kerr Engine Company
Pittsburgh Valve, Foundry & Construction Company

Ventilating & Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Company
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.
Wilson, Limited, John T.

Vacuum Cleaners
Tuec Company

Varnish
Dougall Varnish Co.

Varnishes—Insulating
Standard Underground Cable Co. of Canada. Ltd.

Wall and Joist Hangers
Taylor Forbes Company

Wall Board
Bird & Son

Waterproofing
Cabot Inc., Samuel
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Ceresit Waterproofing Co.
Wadsworth Howland & Co., Inc.

Water Softeners and Filters
American Water Softener Co.
Equipment & Supplies, Limited.
Manitoba Bridge & Iron Works.

Water Tapping Machine
Mueller Mfg. Co., H.

Water Turbines
Canadian Allis-Chalmers, Ltd.
Boving Company of Canada
Escher Wyss & Co.
Hamilton Mfg. Co., Wm.
McDougall Caledonian Iron Wks.

Well Drilling Machinery
Armstrong Manufacturing Co.

Wire Glass
Pilkington Bros.

Wires and Cables
Canada Wire & Cable Co.
Northern Electric Co.
Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
Canada Wire & Iron Goods Co.
Greening Wire Co., B.

Wire Rope
Canada Wire & Cable Co.
Greening Wire Co., B.

Wrenches
Canadian Billings & Spencer, Ltd.

Wrenches
Can. Billings & Spencer, Ltd.

Tarvia

Preserves Roads
Prevents Dust—

Eaton Road, Islington, Ont., Canada—Treated with "Tarvia A". This is one of the heaviest-travelled roads leading out of Toronto, and carries a great amount of steel-tired vehicular and motor traffic.

English Approval

The processes for protecting roads by the use of tar materials against too rapid attrition by automobile traffic came into use in England about the same time that they did in the United States and Canada, but the English macadam road traffic is even harder than ours owing to the use of traction trains and heavy traction engines on the roads.

The popularity of the tar treatment with English engineers is demonstrated by a glance at a typical list of specifications issued by the Road Board. A list printed in the London Surveyor recently shows a total area to be treated by special tar process of *over two million square yards.*

In Canada Tarvia has been very successful as a road binder. It is a product of the scientific combination of refined coal tars especially prepared for use on roads. Unlike crude tar, it is even in consistency for a given grade, presents no difficulties in heating and handling, is uniform in character and can be relied upon to be exactly the same from year to year.

The Tarvia treatment encloses the stone in a tough, durable, waterproof matrix, from which automobile traffic or water erosion will not tear it loose.

It brings about such economies in maintenance that the cost of the Tarvia is more than paid for. Tarvia is made in three grades: "Tarvia X" for new or rebuilt roads and pavements, "Tarvia A" for surface application, and "Tarvia B" for dust prevention and road preservation.

Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N.B. HALIFAX, N.S. SYDNEY, N.S.

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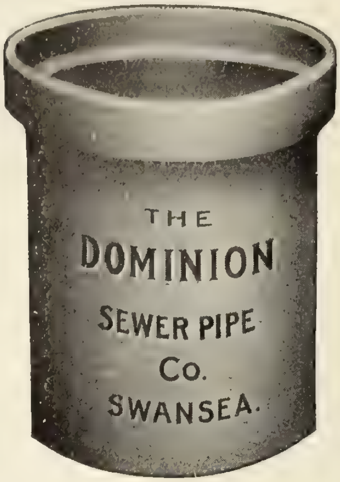

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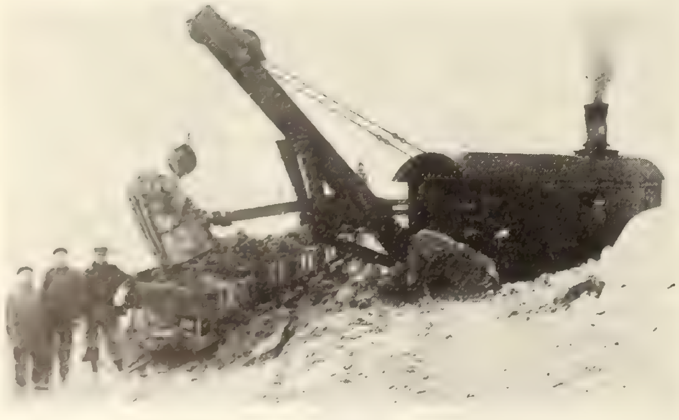

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April 1st	1½ cu. yd.	490	612
April 2nd	1½ cu. yd.	595	744
April 3rd	1½ cu. yd.	550	687
April 4th	1½ cu. yd.	575	719
April 6th	1½ cu. yd.	375	469
April 7th	1½ cu. yd.	500	625
April 8th	1½ cu. yd.	175	219
April 9th	1½ cu. yd.	520	650
April 10th	1½ cu. yd.	370	462
April 11th	1½ cu. yd.	640	800
April 13th	1½ cu. yd.	556	695
April 14th	1½ cu. yd.	495	619
April 15th	1½ cu. yd.	393	491
April 17th	1½ cu. yd.	714	892
April 18th	1½ cu. yd.	560	700
April 20th	1½ cu. yd.	275	344
April 21st	1½ cu. yd.	510	637
April 22nd	1½ cu. yd.	525	656
April 23rd	1½ cu. yd.	555	693
April 24th	1½ cu. yd.	525	656
April 28th	1½ cu. yd.	165	206
April 29th	1½ cu. yd.	215	269
April 30th	1½ cu. yd.	350	437
Total 23 days		10,628	13,282
Average per 10-hour day		462	578

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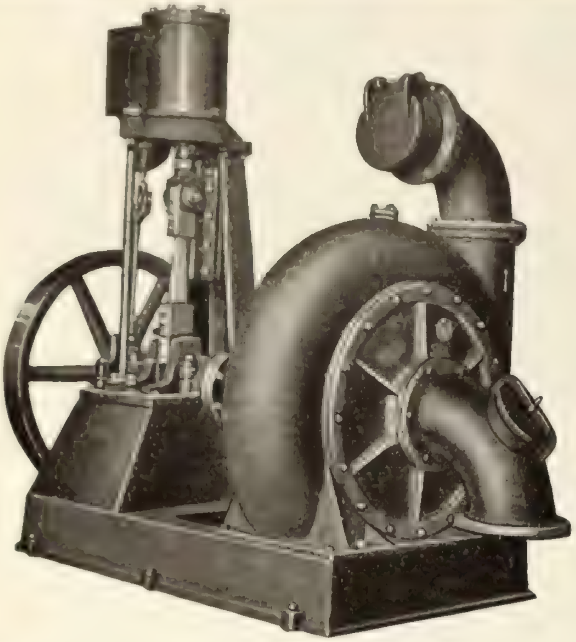

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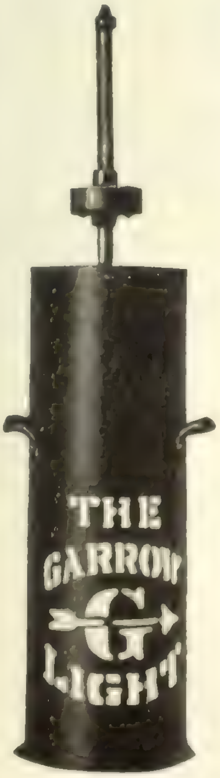

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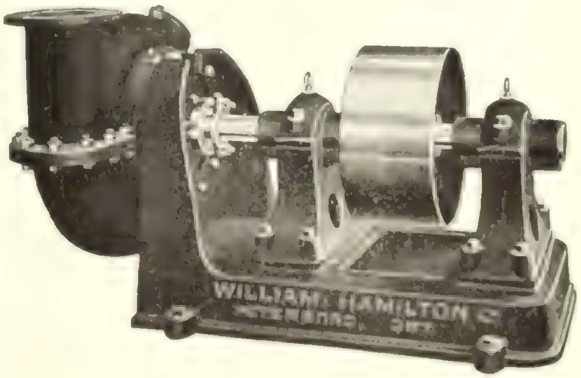

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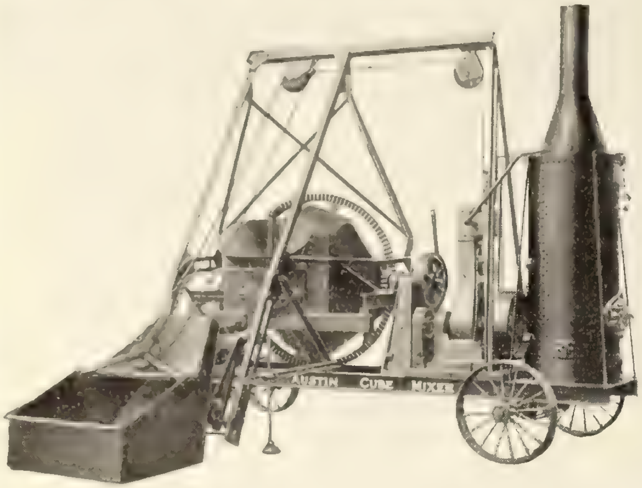

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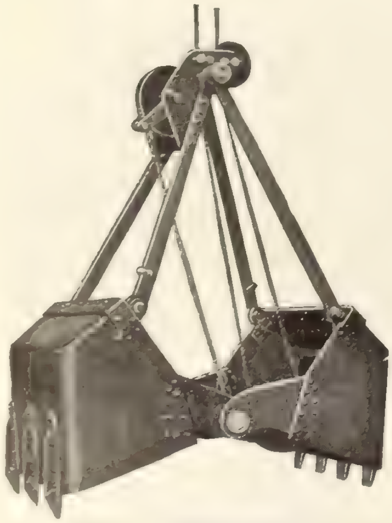

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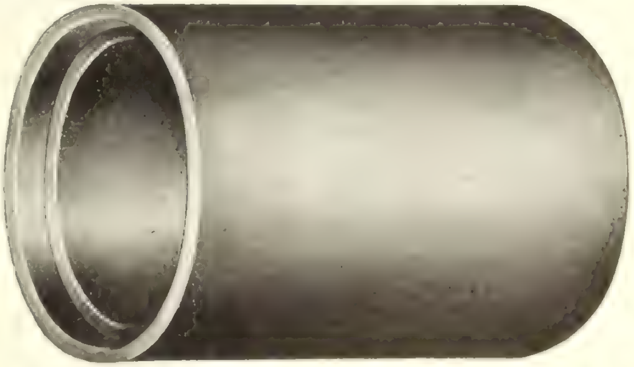

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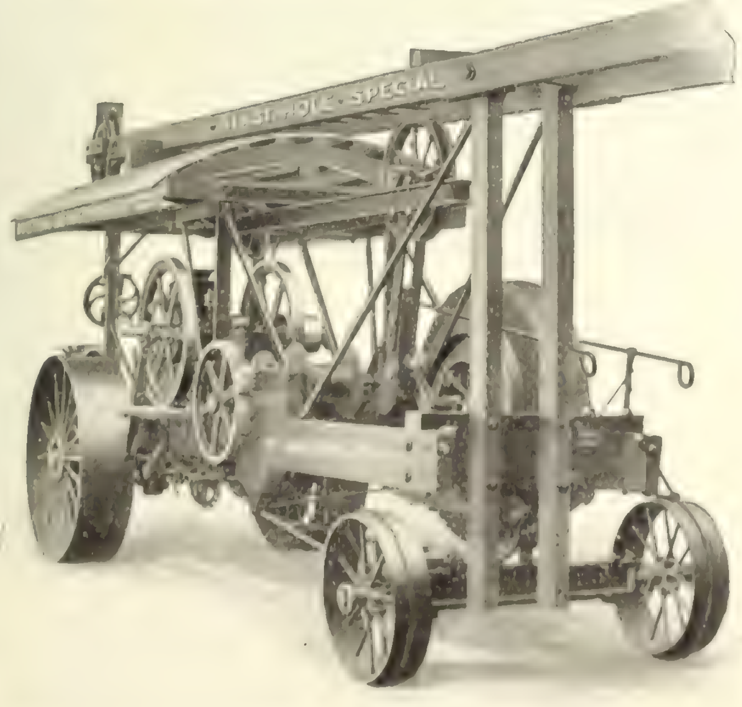

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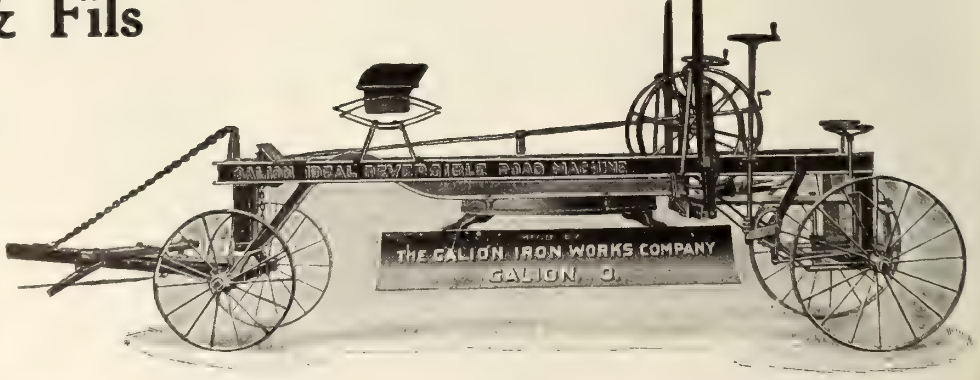
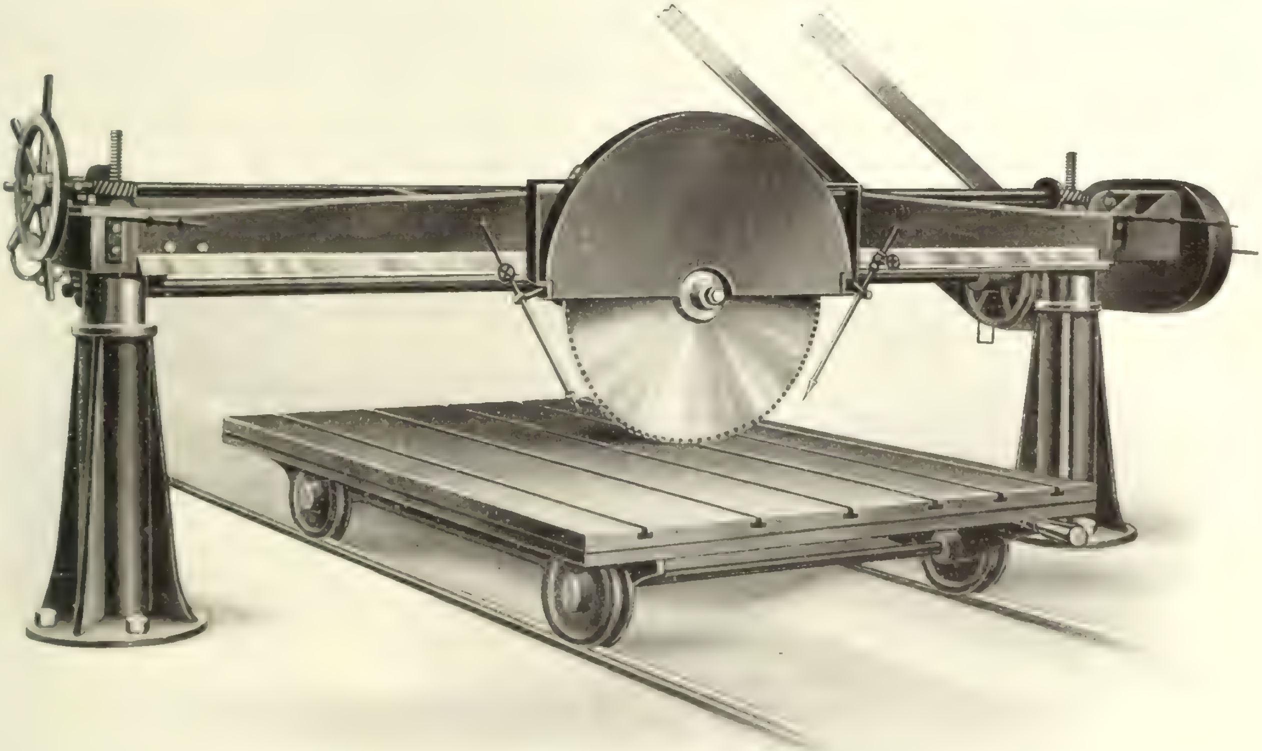

GALION IDEAL REVERSIBLE ROAD MACHINE
THE GALION IRON WORKS COMPANY
GALION, O.

**362 Craig St. West, Montreal
and Laprarie, Que.**

Anderson's Coper and Cross Cut Diamond Saw



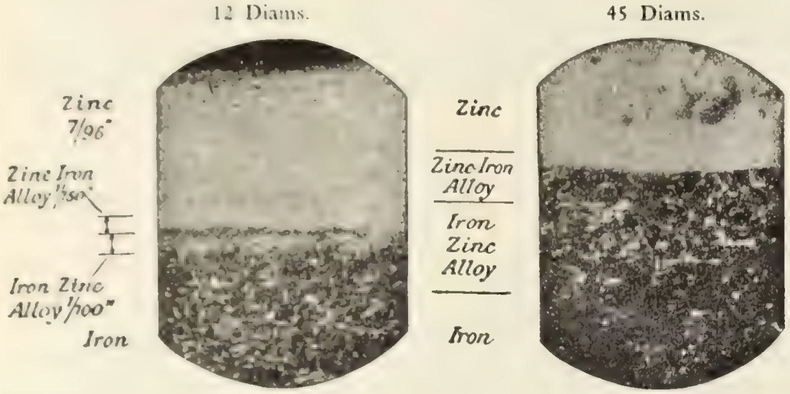
Simple of control ***Highly efficient***

Copes Marble, all four sides with one setting. Top part of table revolves and has notches for Hexagons, Octagons, as well as Squares.

Can be changed from Coper to Diamond saw in few minutes.

George Anderson & Co. of Canada, Ltd.
617 Quebec Bank Building, MONTREAL

Sherardized Herringbone Lath

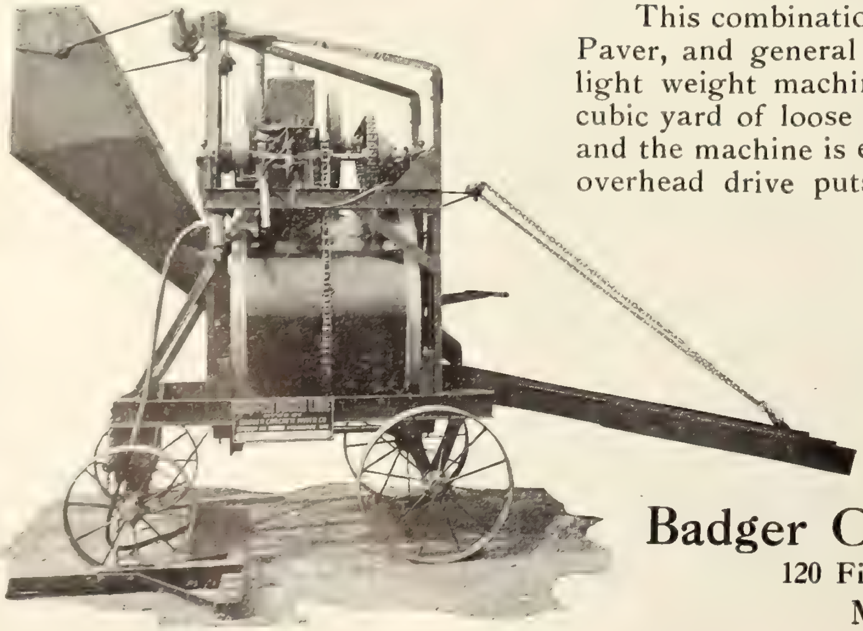


is protected by a coating which is so firmly bonded to the steel that the surface of contact between the steel and the zinc disappears. Instead there is an intervening layer, made up of zinc-iron alloy in varying proportions. Metallurgists tell us that this is the condition for ideal protection. Practical men appreciate a coating that cannot possibly chip off.

There is only one way to specify the *very best* metal lath. Specify *Sherardized Herringbone.*

Clarence W. Noble, ***General Sales Agent***
117 Home Life Building, TORONTO
The Metal Shingle & Siding Company, Manufacturers

Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

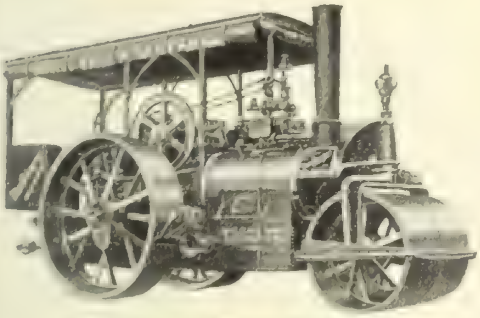
Write for our prices—they will interest you.

Badger Concrete Mixer Co.
120 First National Bank Bldg.
Milwaukee, Wis.

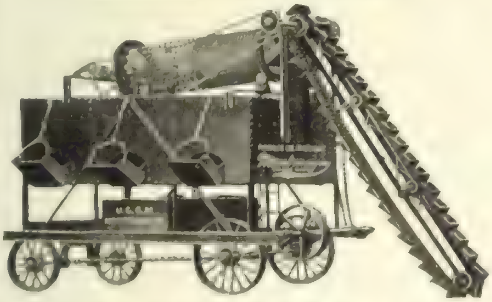
General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** Montreal

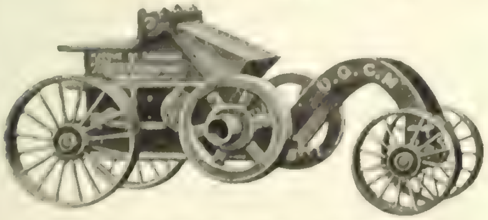
Head Office and Works



"Montmagny" Steam Road Roller.



"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny"
Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit

WRITE US FOR CATALOGUE

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

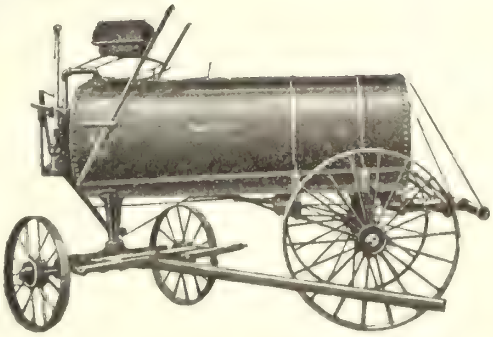
Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

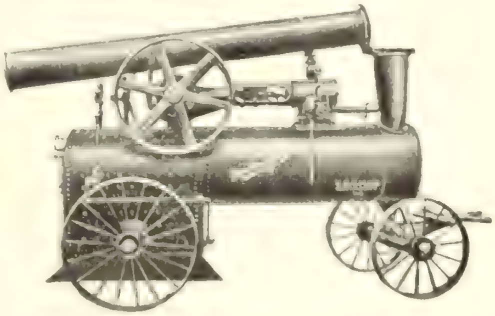
The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

For crushing field stone, granite, etc., "Montmagny" jaws are made of **manganese steel**. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.



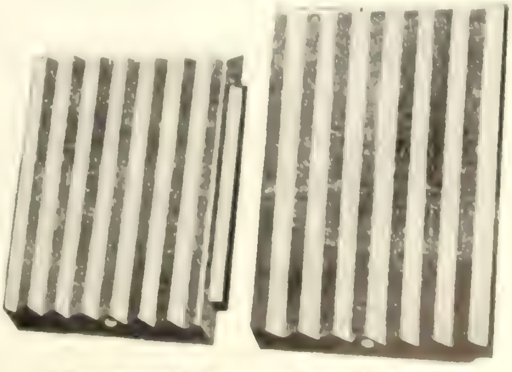
"Montmagny" Road Sprinkler.

The "Montmagny" all steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.



"Montmagny" Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.



"Montmagny" Manganese Steel Jaw Plates

J.O.B. CONTRACTORS PUMPS

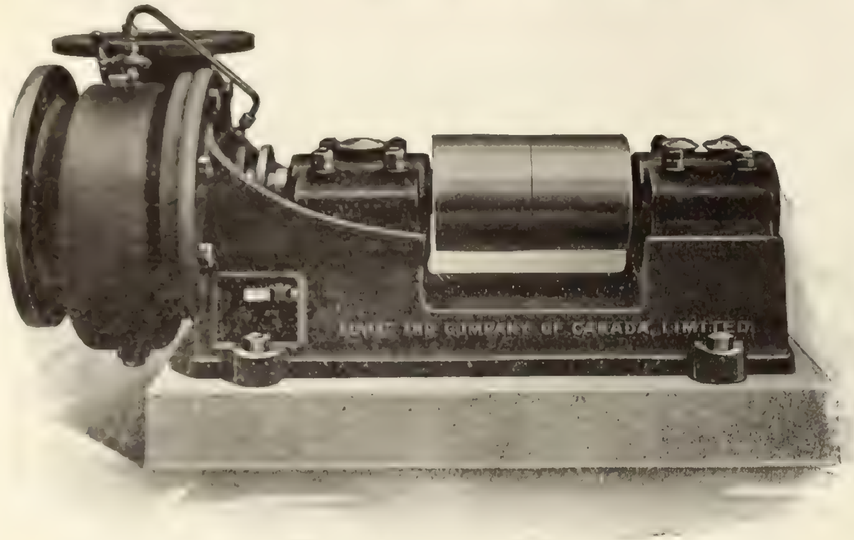


Illustration shows 10″ Contractors Pump.

Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

Let Us Quote on Your Requirements

Pumps for all purposes
- Belt Driven
- Direct Connected
- High, Medium and Low Pressure

Boving & Co. of Canada Limited

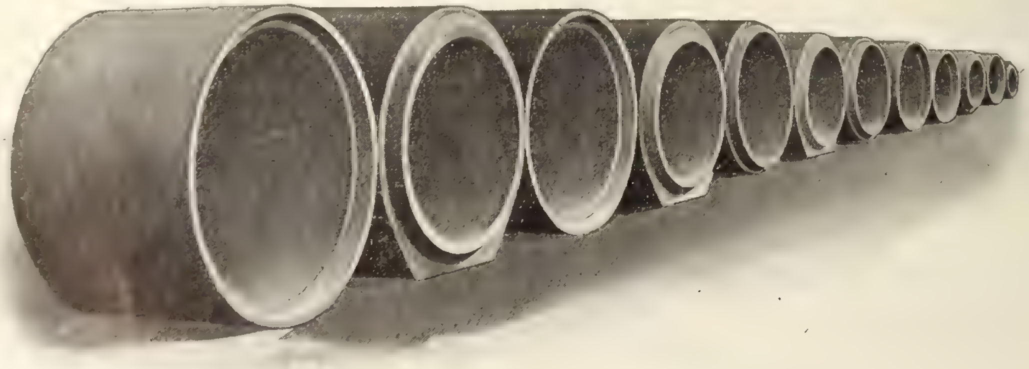
Head Office: 164 Bay St., TORONTO
MOOSE JAW: 94 Grafton Ave.
Works: LINDSAY, ONTARIO
VANCOUVER: London Bldg.

Everything in Concrete and Cement

The most modern plant in Ontario, plus unsurpassed manufacturing facilities and the use of the best raw materials are the forces governing the output of our concrete products. Our manufactures include building blocks, silo blocks, concrete fence posts, railroad pipes, and culvert and sewer pipes.

We make a point of supplying special ornamental trimmings for public buildings, churches and schools.

Your enquiries are respectfully solicited, and will receive prompt attention.



National Concrete Mfg. Company, Limited

LINDSAY, ONTARIO

Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

Manufacturers of

"Adamantine," Chrome and Manganese Steel Castings

(Annealed and Unannealed)

TRADE MARK

Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass Bronze and Aluminum Castings.

Cement Mill Machinery

Our Specialty

- Tube Mill Feeders
- Griffin Mill Roll Heads
- Ball Mill Plates for Krupp Mills
- Kominuter Plates for Smidths Mills
- Steel Balls for Kominuters
- McCaslin Conveyer Wheels with "Coplan" Self-Lubricating Bushings
- Lining Plates for Bonnot Tube Mills
- Parts for Bonnot Pulverizers
- Screw Conveyer Bearings
- Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
- T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

We solicit your patronage and prompt attention will be given to tenders on above work.

Montreal Office, New Birks Bldg. Phone up-town 4069

TOXEMENT

Gooderham Fountain, Canadian National Exhibition. Basin of fountain waterproofed with TOXEMENT. Send for Booklet.

"R. I. W." DAMP RESISTING PAINT CO., - TORONTO

Office: 202 Mail Building, Toronto **(Toch Bros.)** **Factory: Oakville, Ont.**

Distributors: [illegible] Building Supply Co., Limited, Toronto; Dartnell Limited, Montreal; Gandy & Allison, St. John, N.B.; A. F. [illegible]; [illegible] Hardware Co., Limited, Halifax, N.S.; Western Paint Co., Winnipeg; Carter, Dewar, Crowe Co., Vancouver; [illegible] Building Supply Co., Fort William; Canadian Equipment & Supply Co., Limited, Calgary and Edmonton. **Write our nearest distributor for full information.**

Pressure Tanks
Washing Tanks
Steel Reservoirs
Steel Retorts
Storage Bins
Air Tanks
Gas Tanks

Any Size Any Style
Any Number

BULLETIN NO. 400

WATEROUS

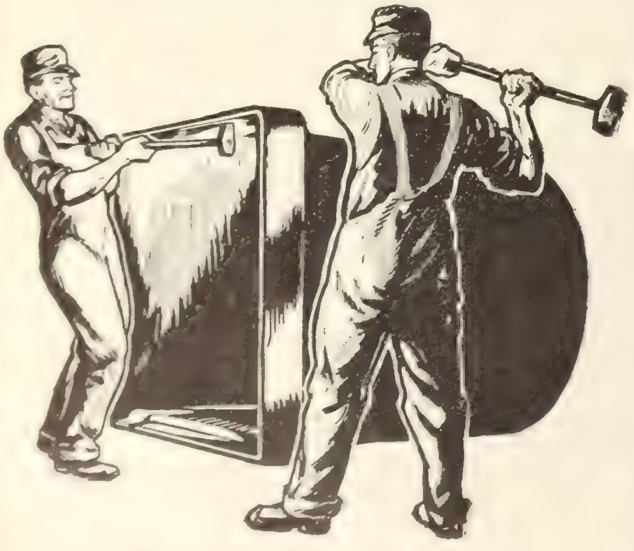
STEEL PLATE TANKS

Most Steel Tanks are built to order, and you know what that kind of special work generally costs. Generally that is—not always.

In our boiler shop a separate department is kept busy building Steel Plate Work. Continual experience has taught us how to handle every kind of special tank job that comes along, in the best way to keep down production costs.

That's why we are able to build tanks to suit your special requirements at a price that is ***not special.***

Send your sketches to us. We will quote you prices that are attractive. Remember, we guarantee our workmanship.

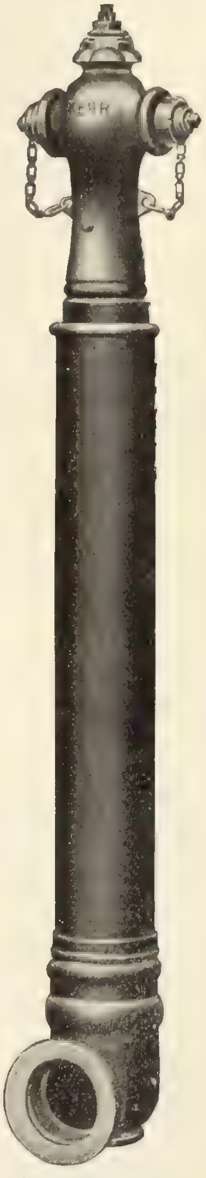


The Waterous Engine Works
Co., Limited, Brantford, Canada

KERR

Hydrants
and
Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.



Standard Compression Hydrant

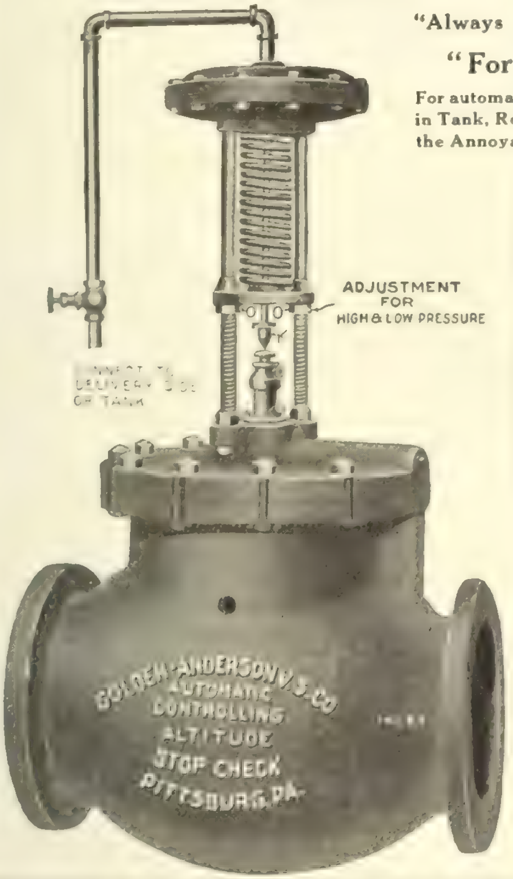
Send us your Specifications and Enquiries.

Prompt attention given.

6" Hubbed

THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

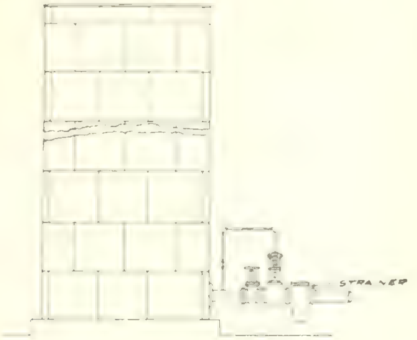
The Golden-Anderson Pat. Cushioned Controlling Altitude Valves



"Always Cushioned in Opening and Closing"

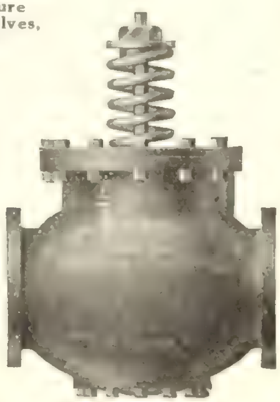
"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.

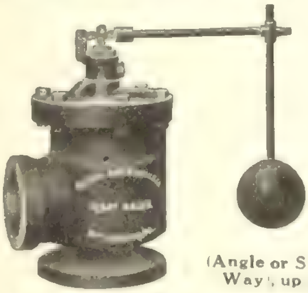


Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.

Automatic Cushioned Water Pressure Regulating Valves, up to 24



Golden-Anderson Float Valves



(Angle or Straight Way), up to 24

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg. Pittsburgh, Pa.

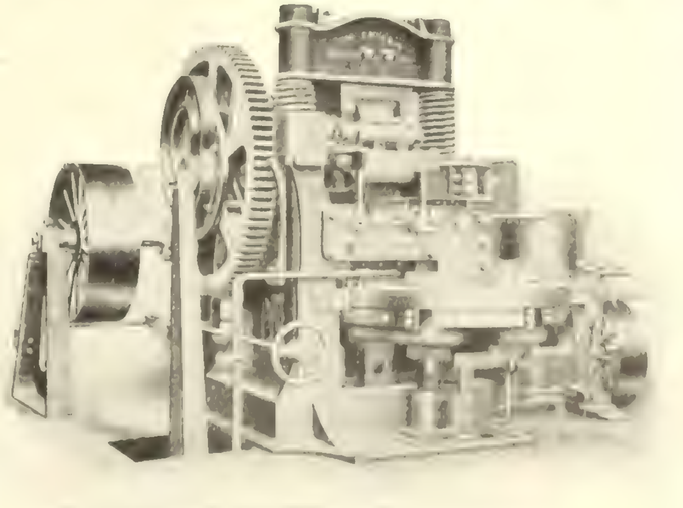
BRICK PLANTS

Lime-Sand

Clay, Slag,

Clinker,

&c., &c.



Installed

Complete

on Best

Lines.

World Wide Experience.

SUTCLIFFE, SPEAKMAN & CO., LTD. LEIGH,

CABLES—"Utilization Leigh" CODES—[illegible] LANCASHIRE, ENG.

What's the Time?

There would be no argument on this subject if the "PULSYNETIC" Electric Clocks were installed.

They are invariably correct because they depend on the unvarying force of gravity.

Accurate and uniform time is shown throughout any building in which they are installed.

Easily fixed, no winding and no skilled attention is required.

Send for Book No. 5

which contains fullest information about all classes of Electric Clocks.

GENT & CO., LTD.
Leicester, England

BUILDERS' SUPPLIES

- Lime
- Portland Cement
- White Cement
- Keenes Cement
- Plaster Paris
- Hard Wall Plaster
- Mortar Colors
- Fire Brick
- Sewer Pipe
- Weeping Tile
- Sacketts Plaster Board
- Parkers Corner Bead
- Rubble Stone
- Crushed Stone, Etc.

With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

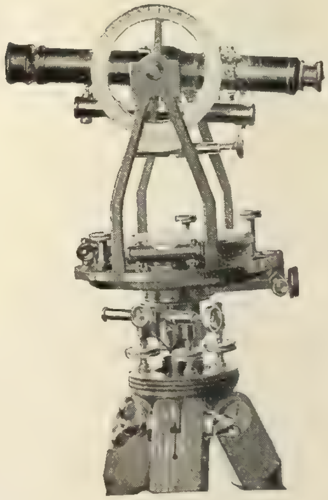
Ontario Lime Company
Limited
Crown Office Building, Toronto, Ont.
Head Office Phones: Main 5472—5473

In response to a demand

for a very light transit for rapid work, we introduced in 1887

The Gurley Reconnoissance Transit

Its continued popularity is due to its medium weight (about 7¾ lbs.), its reliability for a variety of uses and its reasonable price.



No. 100
Reconnoissance Transit
Price complete, $115.00
Including Extension Tripod
F. O. B. Troy or Seattle

Write for catalog. It tells all about Gurley Instruments for Civil Engineers and Surveyors, Highway Engineers, Contractors and Builders.

W. & L. E. Gurley, Troy, N. Y.
Makers of Engineers Instruments Since 1845
Branch Factory - Seattle, Washington

Read This Letter

Chase, Florida, March 28th, 1914

Ceresit Waterproofing Co.,

Gentlemen:—

The tank we waterproofed with your Ceresit four years ago is in as good condition to-day as when we first built it. Your Ceresit is certainly the real waterproofing compound.

Yours very truly,

Florida Keys Sponge & Fruit Co.

By Chas. W. Chase, Jr.

The tank mentioned is an 80,000 gallon concrete cistern at Sugar Loaf Key, Florida. Ceresit was used in the concrete and also in the cement mortar coating on the inside of the cistern. The foundation of the cistern is several feet below the tide level. There has been neither leakage nor seepage of sea water into the cistern.

CERESIT

TRADE MARK

The Waterproofer for Cement That Always Gives Satisfaction

Right results with Ceresit are the rule, not the exception—and there is no exception to the rule. Ceresit is a sure and permanent waterproofer for cement and we can prove it. You owe it to yourself to investigate. Write for the "Book of Evidence."

CERESIT WATERPROOFING COMPANY

913 Westminster Building, CHICAGO, ILL.

FACTORIES—Chicago, Unna, Germany, London, Paris, Vienna, Warsaw

LIST OF DEALERS—W. B. Poucher, Edmonton, Alta.; E. G. Cullen, Vancouver, B.C.; Walkers, Ltd., Winnipeg, Man.; R. deB. Carrite, St. John, N. B.; W. K. Macdonald Co., Toronto, Ont.; McLellan Peters Co., 305 Read Bldg., Montreal; The Whitlock-Riddell Co., Moose Jaw, Sask.; Brown & Chapman, Regina, Sask.; MacKenzie & Thayer, Ltd., Saskatoon, Sask.; N. G. DeHaas, Sault St. Marie, Ont.

TWO GOOD THINGS TO USE

THEY GO WELL TOGETHER

A MIX A MINUTE

represents the speed of the

"BIG-AN-LITTLE" Concrete Mixer

This is no exaggerated estimate, as the mixer makes from fifteen to twenty revolutions every minute, turning the material two and a half times at each revolution.

The Big-an-Little Mixer is a medium-sized machine, adapted for either big or small jobs. It is made of iron and steel throughout and can be operated at a cost of three cents per hour.

We guarantee this mixer to give as good results as the larger and more expensive machines, and will replace any defective part providing the claim is made within one year from date of delivery.

Write us for full particulars and prices

"A Mix a Minute"

Jaeger Machine Co., Columbus, Ohio

Our plant at Mascouche, P. Q.

Enamel Concrete Brick

Our factory is specially designed to produce enamel concrete brick of the highest quality. 3,200,000 pounds of pressure is exerted on every eight brick in the process of manufacture. Think of the meaning of this statement in connection with the permanency and durability of the product.

The National Builders' Supply & Enamel Concrete Brick Co., Limited
30 St. Francois Xavier St., MONTREAL

High Calcium Lime

Manufactured by

The Dominion Lime Company,

SHERBROOKE, - - PROVINCE OF QUEBEC

Its Special advantages are:

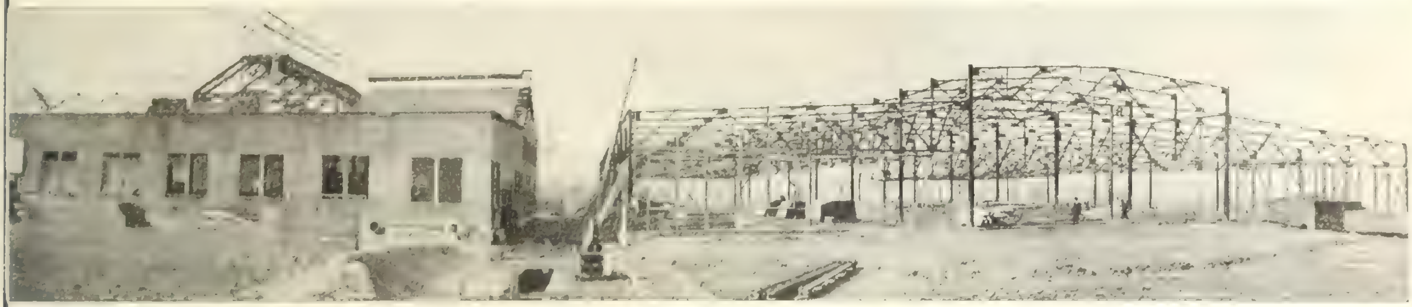
Strength,
Whiteness,
Purity

Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

THE HAMILTON BRIDGE WORKS COMPANY, LTD., Hamilton, Canada



ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons

STEEL BRIDGES AND BUILDINGS

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460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

Write for catalogue

H. R. HEINICKE, INC. New York, U. S. A.

Representatives for Canada:
Black Building Supply Co., Ltd., Toronto
Dartnell Ltd., Montreal, Que.

Service

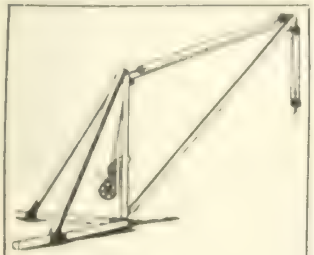
We have unequalled facilities for making prompt shipments and can guarantee deliveries to date.

Our line of bricks comprises

RED PRESSED BRICK
RED WIRE-CUT BRICK
RED RUFFESTRY BRICK
FLASHED PRESSED BRICK
FUSED PRESSED BRICK

Write us for samples and prices

Russell Shale Bricks, Ltd.
RUSSELL, ONT.



Stiff Leg, [illegible] ton capacity with double drum winch for hand or power

SASGEN DERRICKS

For Builders and Contractors

Sasgen Derricks have been used on some of the biggest building projects undertaken and accomplished in recent years. The "A" Frame Builders' Derrick illustrated is very practical for hoisting and setting girders, iron beams, heavy joists, etc., and is a great time and labor saver

Our Stiff Leg Derrick has many advantages over other makes such as split mast and boom, steel fittings throughout, etc.

Our Prices are Right and our Derricks the Best on the Market. Your enquiries will be appreciated

"A" FRAME BUILDERS' DERRICK [illegible]

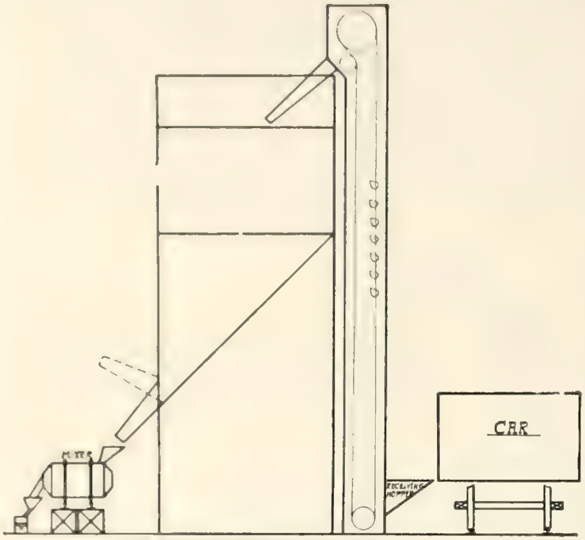
SASGEN DERRICK COMPANY - Wabash Ave. TORONTO

WRITE FOR CIRCULAR "R"

A Portable Storage System

FOR HANDLING

Bulk Cement, Crushed Stone, Sand and Gravel



—WELLER PORTABLE STORAGE SYSTEM—

Labor in handling these materials from cars to mixer or wagon is a large item.

Figured with delays in car spotting and similar items.

These unnecessary charges will vary from 25c. to $1.00 or more per yard of concrete.

By installing a **WELLER PORTABLE STORAGE SYSTEM** you can buy cement in bulk, thus saving cost of sacks, handling and return charges on same, as well as dispensing with all hand labor on any material after original unloading.

All material stored clear of the ground and fed to mixer or wagons by gravity.

Suitable to batch or continuous mixing systems.

When job is finished, take down and move to next location, or store away until needed.

WELLER MFG. CO., Chicago

Greater Efficiency at Lower Cost

By using the

SHEARER & MAYER

Dragline Cableway Excavator

(Patented and Manufactured in United States and Canada)

For Wet and Dry Excavation

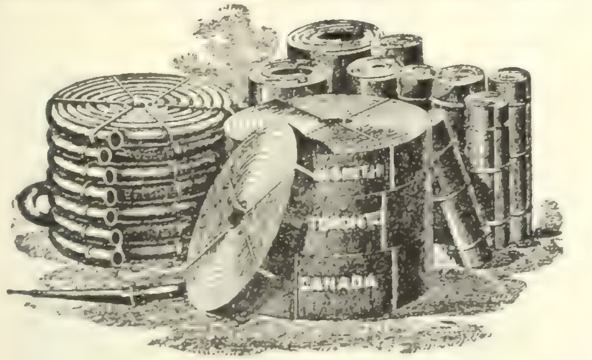
The illustration shows one of the many problems solved by means of this machine. The cemented gravel extends from the top down below the surface of the water. In the past work of this description called for equipment of steam shovels, industrial cars, elevators, etc., to move the gravel from pit to plant. But the Shearer & Mayer excavator built for the severest service excavates, elevates and conveys the material from pit to plant in one continuous forward operation. The dumping operation is rapid, automatic and under POSITIVE CONTROL of operator, thus insuring a well separated product when delivering to screens. If you have a contract involving the moving of gravel, stripping over-burden or other heavy earth material, investigate this machine. If adapted to your conditions it will save you money. Write and consult us on your excavating problem.

SAUERMAN BROS. 1140 Monadnock Blk.
CHICAGO, ILL.

Dragline Cableway Engineers and Selling Agents

Alberta and Saskatchewan Agents:
CAN. EQUIPMENT & SUPPLY CO., Calgary, Edmonton, Regina

BELTING



Look over this list—it will save you many dollars.

NET PRICE LIST PER FOOT

Rubber Belting

Width Inches	4 ply	5 ply	6 ply
4	16	20	
5	20	25	
6	25	30	35
8	31	36	40
10	40	47	55
12	50	60	70
14	55	70	80
16		80	90

Stitched Canvas Belting

Width Inches	4 ply	6 ply
4	13	18
5	17	23
6	20	27
8	25	36
10	32	45
12	37	55
14	45	69
16		79

Write for complete NET PRICE LIST

N. SMITH, 138 York St., Toronto, Ont.

Dowling Ave., Highway Bridge, Grand Trunk Ry. Toronto, Canada
Waterproofed with J-M Waterproofing Materials.

Let our Waterproofing experts co-operate with you

Our Engineering Department will be glad to co-operate with you in working out the technical details of any waterproofing problem, large or small. Many of the largest waterproofing jobs in the Dominion have been successfully executed under the direction of our engineers, using

J-M Waterproofing Materials

These materials are practically everlasting because they are all-mineral in character—a combination of Asbestos fibre felts and the purest natural Asphalt, refined in our own factories.
We are also prepared to take contracts for the application of J-M Mastic Flooring in abattoirs, breweries, factories, reservoirs, etc.

Write our nearest Branch for full particulars

2107

**THE CANADIAN
H. W. JOHNS-MANVILLE CO., LTD.
TORONTO MONTREAL WINNIPEG VANCOUVER**

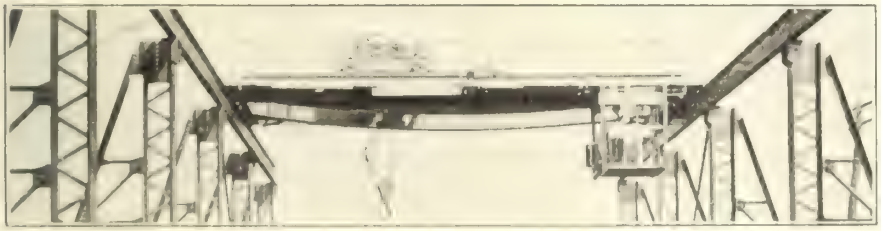


Illustration of a STANDARD ELECTRIC OVERHEAD TRAVELLER.
Capacity 20 tons. Girders Box Plate Type.

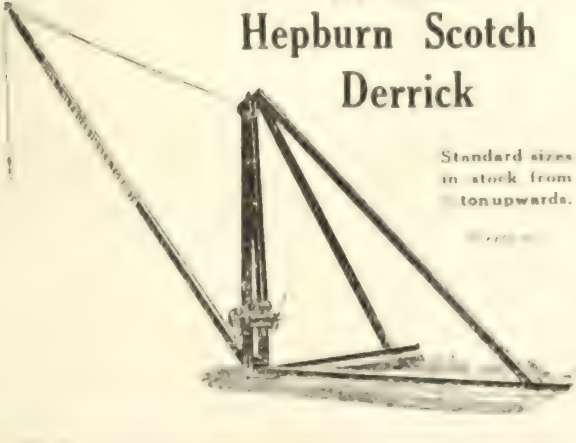
Specialists in all lines

Contractors Equipments

The Famous

Hepburn Scotch Derrick

These derricks can be fitted with steam or electric power if necessary.



Standard sizes in stock from [illegible] ton upwards.

All Types of

CRANES

for

Stone Yards, Machine Shops, Builders and Contractors, Quarries.

Contractors and Builders Equipments

Hand Winches, Tripods, Breast Derricks, Chain and Leg Lewises, Stone Hooks, Post Caps and Bases.

**Electric Derricks
Electric Winches
Electric Capstans**

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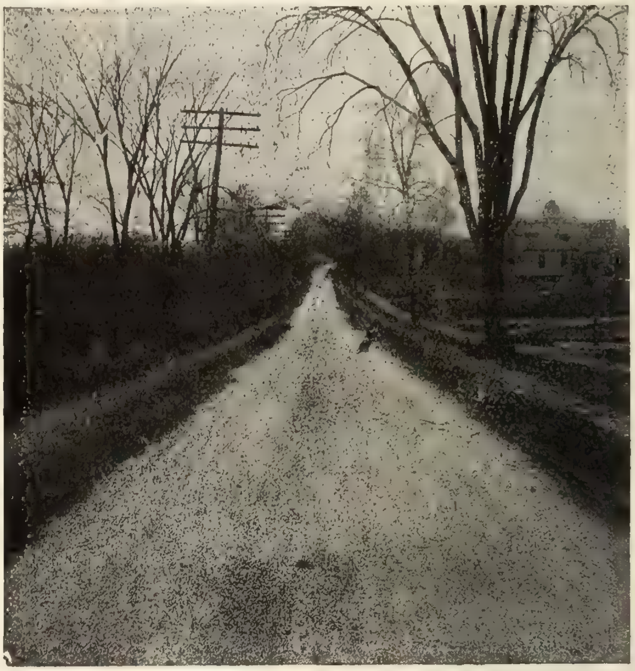
BERMUDEZ ROAD ASPHALT

"IT STAYS PUT"

Photograph taken 1909



Photograph taken 1913

Hudson-Hollowville State Road, New York. Constructed 1909.

After Four Years

most roads show signs of disintegration. The road above pictured is actually in better condition to-day than it was a few months after it was built.

It has "ironed out" beautifully, and the entire absence of loose stone shows that the binder, Bermudez Road Asphalt, has all the "life"—adhesiveness and cementing qualities—that it had when it was put into the road.

"It Stays Put"

because Bermudez Road Asphalt is lake asphalt. The influences that destroy man-made products had exhausted their effect upon this material before it was dug from the tropical asphalt lake of Venezuela.

Bermudez asphalt roads do not go to pieces because the binding material has an indestructible life. Its cementing power to hold the stone of the road in place lasts as long as the stone lasts.

More about Bermudez is told in the Bermudez Road Book, of which we shall be glad to send a copy to anyone interested in permanent good roads.

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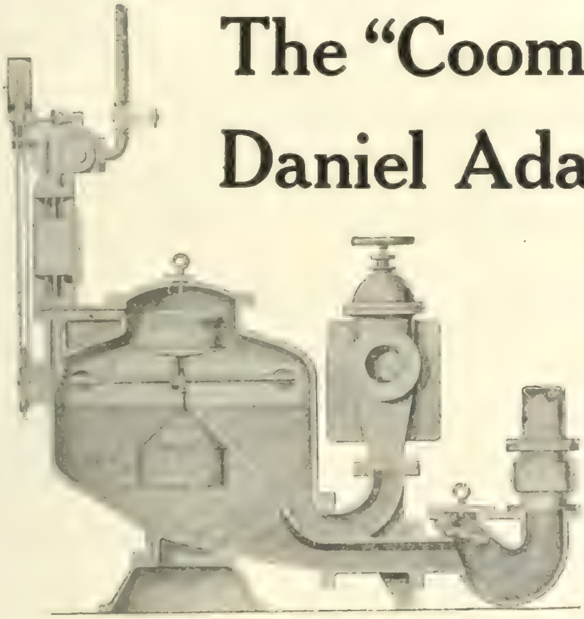
The "Coomb's" Pneumatic Ejector

Manufactured by

Daniel Adamson & Co., England



Sectional view of "Coomb's" Ejector

Coomb's Ejectors are made in many different sizes and can be arranged for any volume of flow. Operation is entirely automatic, attendance is only required at the ejector chamber for periodical inspection.

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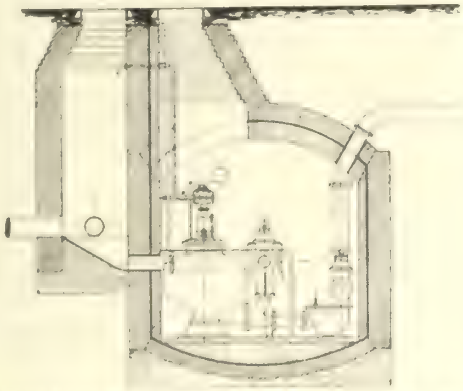
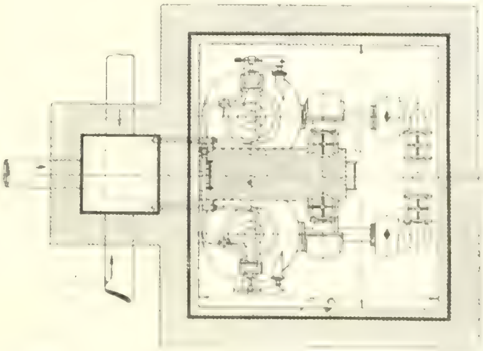


Plan showing typical arrangement of a pair of "Coomb's" pneumatic Ejectors in a brick chamber placed below ground level.



Sectional elevation showing typical arrangement of "Coomb's" Ejector in chamber below ground level.

EJECTORS can be placed ABOVE GROUND if the Coomb's HIGH EFFICIENCY type is used. In this case the ejectors act as suction and face pumps. While one ejector is being filled by suction the other is emptied by air pressure. In bad ground a great saving in construction cost is effected—no chambers are necessary. With HIGH EFFICIENCY ejectors the air exhaust is so arranged that instead of waste air being discharged to the atmosphere it is RECOMPRESSED and used over again with a small percentage of loss.

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ESTABLISHED 1886

Contract Record and Engineering Review

Published Each Wednesday By
HUGH C. MACLEAN, LIMITED
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - Tribune Building
CHICAGO - Tel. Central 6403 - 1155 Peoples Gas Building
LONDON, ENG. - - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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The Making of a Technical Journal

ONE of the most interesting and informative papers we have read in a long time is an address before the Western Society of Engineers, delivered by Mr. E. J. Mehren, Editor of the Engineering Record. In several respects, the paper, which comprises a review of the organization, work and functions of the technical journal, might be taken as the text for an interesting editorial, but it is sufficient for the purpose in hand to comment upon one or two points.

In the first place it is of interest to note the manner in which Mr. Mehren traces the development of the technical journal. Time was when its primary function was to supply the engineer with information as to the latest developments in the field, but gradually there came a demand for information as to constructional methods, equipment, news of enterprises, and so on—a demand which has taken the technical journal out of the strictly professional class and made it an indispensable business commodity as a specialized news organ.

The importance of the Contract News section is well emphasized. It may not be out of place, perhaps, to say that this particular section of the Contract Record has been developed and improved upon for years until now it is conceded that the service is approaching a state of real usefulness. Mr. Mehren tells us that "the secret of true and reliable news gathering lies in the development of a strong and interested clientele" and that "such a clientele is the chief asset of a technical journal." With this we are entirely in accord. The evidence of "a strong and interested clientele" in the Annual Number of this journal (May 13) was most gratifying.

A useful pointer is given to engineers and contractors in the advice to compress descriptive material within the smallest possible limits consistent with lack of ambiguity. Undoubtedly the padding habit is the worst fault of contributors to this kind of journal. The padding may be done unconsciously, but it is there, and it detracts from the value of an otherwise useful contribution. In this respect Mr. Mehren says: "The engineer naturally feels that his own project is of transcendent importance and, instead of picking out the unusual or most interesting features, he describes details that are of interest only to himself and to his associates in the work. . . . . Five one-column articles are preferable to one five-column article."

The desirability of appealing to the "human" side of the engineer is well made the subject of special mention. Assuredly the live technical journal of to-day must get away from that "deadly sameness" which characterized the pioneers in the field. To be really successful a journal must disclose careful thought and enterprise: thought in its editorial policy and enterprise in every department of its activity. A continuous effort must be made to secure live, informative illustrations—pictures that disclose, in part at least, the story of the work.

In the future of technical journalism Mr. Mehren sees wonderful opportunities for expansion. Here again we are entirely in accord with his views. We feel that in Canada, particularly, there is room for the development of such a paper as the Contract Record and Engineering Review upon such a scale as to make it a sine qua non in the life of every man identified with constructional enterprise. Mr. Mehren shows very well the part of the technical journal in expounding sound doctrine and in influencing the general public through the medium of the daily newspapers. We cannot think that in any other country than Canada can such a part be more potential.

Mr. Mehren has shown us a policy which has established his own journal on a high pinnacle of usefulness and attainment, and by the same token he has confirmed our views as to the means of reaching such a pinnacle of achievement on this side of the border.

A Revised Price List

IT may be an opportune time to direct the attention of the reader to the current price list of constructional materials published in this journal in an entirely revised form. We are now publishing Montreal, Toronto, Winnipeg and Vancouver prices and we shall appreciate co-operation on the part of the reader in keeping the information reliable and up-to-date. We are anxious to have suggestions and to know of any errors or deficiencies.

Of price lists in general, time and time again the complaint has been made that the material is "stale," that it is impossible to keep it up-to-date; that the figures given are inspired by manufacturers, and so on. In all such charges we take it that there is a vestige of truth, but we hope to eliminate most of these troubles and to give such quotations as may provide ready reference for the engineer and contractor—particularly in the way of comparative information. By frequent revision and painstaking work we hope to maintain a high average of accuracy. Occasionally the information may not reach us sufficiently in advance of publication to enable us to make the desired change—as in the case of a sudden fluctuation in some commodity at, say, Vancouver—but this will be obviated largely by enterprising telegraphic work on the part of the correspondents of this journal in the various centres of activity.

We are inclined strongly to the opinion that this department has functions second only in importance to the Contracts Department. The current price list of this journal, conducted on the lines we have inaugurated, will enable the engineer, architect and contractor to run up a preliminary estimate for work in any section of the country. Naturally, the final figures will arise out of a close personal investigation, depending largely, as such figures do, upon local conditions and the particular character of the work—to say nothing of financial arrangements, but the preliminary estimate plays an important part in contracting operations.

The prices from the various centres will be supplemented by periodical reviews of trade conditions. To such reviews our readers are invited to contribute. Information appertaining to actual prices on the leading lines of material in various places will be particularly valuable. Manufacturers and dealers in builders' supplies are asked to submit weekly price lists for the inspection of those seeking such information at the office of this journal. Supplementary quotations will be given upon request.

The reader is urged to co-operate with us in making this feature indispensable to him.

An International tunnel, said to be the only one in North America to cross an international boundary line, is about to be started on the San Diego & Arizona Railway. Although the bore will be only 620 ft. long, one end will be in the United States and the other in Mexico.

Small Contracts for Large Works

UPON engineers who have to place under contract work involving the expenditure of many thousands of dollars there rests a grave responsibility, comments the Engineering Record editorially. Every large undertaking consists, in effect, of a number of lesser construction operations, related to one another more or less closely, and it is puzzling to determine whether the best interests of a city will be served by awarding one contract for the whole job or by dividing the work into its several elements and receiving separate bids on these smaller units. A case in point is the new mechanical filtration plant at Baltimore.

There is a very interesting moral in the history of the award of this work. At first the principal parts of the plant—the filters, filter equipment, mixing and coagulating basins—were grouped under a single contract. Only three bids were received and all of them were so much in excess of the estimated cost which the city's engineers had prepared that the bids were rejected. The total amounts of these three tenders were remarkably close—the lowest, $971,187, the next, $982,563 and the highest, $1,016,525. On work involving close to a million dollars, the difference between the highest and the lowest bid was only about 4½ per cent. After the bids were rejected the work was divided into smaller contracts and readvertised. The competition was much keener and lower prices were secured. By comparing the lowest original bid, $971,187, with items of a similar nature awarded in subsequent contracts and allowing $22,400 for the price of the filter operating tables, which were not included, a saving of $323,897 was made. From his experience with the Baltimore contracts Mr. J. W. Armstrong (engineer of the city's filtration division) draws the following conclusion: "In public work involving large expenditures where different kinds of construction are involved cheaper and better work can be obtained by dividing it into smaller contracts so that men can bid directly upon the special work in which they are most interested." Of course all engineers will not agree with this conclusion. Often the large contractor's resources in plant, organization and capital are so much greater than those of his smaller competitors that he can underbid them, but there must be sufficient competition to induce him to submit his best figures. It was the division of the work into the smaller units that secured keener competition at Baltimore.

Inadequate Time for Preparation of Tenders

UPON more than one occasion we have voiced editorially the familiar complaint of an inadequate period for the preparation of tenders. We had thought that Canadian municipalities were particularly offensive in this regard, but from an editorial note in a recent issue of Engineering and Contracting they would appear to have competitors in malpractice across the border. Our contemporary's observations, which follow, are to the point.

"Three small cities opened bids last week for public improvements. In each case the time from the first insertion of the official advertisement to the opening of proposals was only seven days. The works were comparatively small as construction undertakings go, yet they were of the utmost importance to the municipalities proposing them. They had been under discussion for many months, the necessary legislation had consumed much time, the preliminary arrangements had taken weeks, and yet when it came to the really important part—the placing of the work under contract—contractors were allowed but one week in which to prepare their bids. This of course cut down the competition. Contractors who had followed the proceedings closely were able to put in their figures. Others who would have been glad of the opportunity of submitting estimates on the work learned of it too late. Instances like these are of frequent occurrence. A small city or town will proceed with the utmost deliberation in getting ready for an improvement and then when the final decision to go ahead is reached there is a hurry up call for bids. Very often the official advertisement is inserted only in the local paper. When this happens the outside contractor, unless he has been notified by the engineer or municipal officials, usually secures his first information of the work from the news columns of the technical journals. It is then often too late for him to obtain the plans and specifications, visit the city, and make the necessary investigations preparatory to submitting a bid. The time element in a public works letting is of the utmost importance both to the municipality and to the prospective bidders. If plenty of time is allowed for the preparation of bids there will be increased competition and better prices will be obtained. Where the time limit is so short that contractors cannot investigate carefully and figure accurately they will either pass up the work or will put in bids high enough to protect themselves from all risks."

Canadian Constructional Centres

A Compendium of Engineering and General Progress Data Relating to the Activities of the Principal Towns and Cities of the Dominion. Arranged Alphabetically by Provinces.

Newfoundland, Nova Scotia, P.E.I., New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia

PART III—Conclusion

WITH Part III, embracing the cities and towns of Alberta and British Columbia, the series of articles relating to the constructional activities of the Dominion is brought to a close in this issue. As stated previously, the aim has been to provide the reader with a ready reference to the engineering equipment of the various municipalities throughout the country and to provide such general figures appertaining to construction as will enable him to arrive at an estimate of recent progress and make deductions accordingly.

It is suggested that this feature be published periodically by the Contract Record and Engineering Review. There would appear to be some ground for this request inasmuch as the information soon becomes "stale" by virtue of the rapid development of the country. It would be a matter of interest to have the views and criticisms of those of our readers who have found value in this series and to publish them in an early issue. The assurance need hardly be given that the suggestions advanced will not die a natural death in the file copies of this journal, but will be tabled for careful consideration in due course. This is essentially a case for the co-operation of the reader.

The towns and cities of the Dominion have now been featured from coast to coast. In Part I. of this series, published in our Annual Number on May 13, we gave the towns and cities of Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick and Quebec, and the cities of Ontario. Part II., which appeared on May 20, comprised the towns of Ontario and the cities and towns of Manitoba and Saskatchewan. Alberta and British Columbia now write Finis to the series.

Alberta

Bassano, Alta.

The history of Bassano dates back only three years, the town having been incorporated in 1911. The population today is 2,000 and the property is assessed at $1,750,000. The 1914 estimate of building work is $150,000 and of engineering work $20,000. Last year's tax rate was 19 mills. The town has three miles of graded roads. The town sewerage system extends 1½ miles with 2½ miles out-fall. Sewage disposal works are now under construction, the extensions planned this season involving an outlay of $5,000. The garbage is destroyed by a Heid incinerator. The water supply is from the Bow River, 3½ miles from the town, the water being pumped into a 200,000 gal. stand pipe. Waterworks extensions are planned at a cost of $[illegible],000.

Calgary, Alta.

The city of Calgary has a population of 80,000. It was incorporated in 1882 and received its city charter twelve years later. In 1909 the population was 30,000. Calgary's extension during recent years has been phenomenal. In no respect is this in greater evidence than in the value of the permits issued for building construction, the returns for the last five years having been as follows: 1909, $2,420,450; 1910, $5,589,594; 1911, $12,907,658; 1912, $20,394,220; 1913, $8,619,653. The estimated building expenditure for 1914 is $10,000,000. The following classification of expenditures in the City Engineering Department during 1913 may be of interest: waterworks extensions, $621,120; sewer extensions, $672,283; paving and grading, $743,347; electric light extensions, $362,431; power extensions, $248,527; street railway extensions, $617,981; paving plant, $50,000. The city has ninety-five miles of graded roads and 54 miles of paving, the classification being as follows: (1) unmetalled dirt roads; (2) wood block; (3) asphalt; (4) concrete; (5) asphaltic concrete; (6) bitulithic. The 1914 programme of road work has not been completed at the time of writing. The sewerage is largely a combined system, especially in the central area of the city. Separate storm sewers are being put in for the outlying districts. The method of disposal is by gravity into the Bow River. Designs are now being prepared for a disposal plant, for which the estimates have not yet been completed. The garbage is collected in single horse dump carts and electric trucks, and is taken care of by two incinerators. With reference to garbage collection, the following figures as to the cost of electric tractors may be of interest. These machines have been in operation about twelve months and have run, on an average, 310 miles a month. The total cost for upkeep, maintenance, repairs, garage rent, salaries, etc., has been $260 a month exclusive of depreciation. The Engineering Department figures that the total cost of the trucks, some $5,500, will be written off in seven years. The city obtains its water supply from the Elbow and Bow rivers, the main supply being by gravity from the Elbow river, the secondary supply being pumped from the Bow river.

Camrose, Alta.

This town has a population of 2,100 and was incorporated in 1907. The 1914 assessment is $1,700,000 and the tax rate 27 mills. It is estimated that $300,000 will be the value of building work and $20,000 the engineering expenditure this year. Of a roadway mileage of twenty, earth roads comprise nineteen miles and macadam roads one mile. Eight thousand dollars has been set apart for road work this season. The sewerage system extends three miles, disposal being by septic tanks and the effluent being treated with chloride of lime. Sewerage extensions planned this season involve an outlay of $6,000. Garbage is dumped on a nuisance ground and burned. The water supply is from three artesian wells, and extensions to the waterworks will be made this season at a cost of $6,300. The electric light and power plants will be enlarged at a cost of $4,000.

Cardston, Alta.

This town, incorporated in 1901, has a population of 1,600—an increase of about 500 in the last five years. The assessment for 1914 is $29,000 and the tax rate 25 mills. It is estimated that $260,000 will be spent on building work this season. There are thirty miles of clay and gravel roads, with sixteen blocks of cement and six blocks of wooden sidewalks. There is a surface drainage system of sewerage with outlet into Lee's Creek. The garbage is collected in wagons and deposited on a dumping ground outside the town limits. Water is obtained from Lee's Creek. Ten-inch wooden pipe mains are used. The waterworks are reported of sufficient capacity to provide for a population of 8,000. The erection of a concrete dam and the installation of an intake are contemplated. In the way of electric light, service and street lighting extensions are contemplated.

Coronation, Alta.

This town, incorporated just two years ago, now has a population of 1,200, with an assessment of $700,000. The estimated building expenditure this year is $500,000 and on municipal engineering work $45,000. Last year's tax rate was 31 mills. At present there is no system of sewerage, but work involving $20,000 is under consideration. The water supply is drawn from wells. Extensions to the waterworks at a cost of $40,000 are now being put in hand, as also are extensions to the electric light plant, involving an outlay of $15,000.

Edmonton, Alta.

It is just ten years ago since the Alberta capital received its city charter and twenty-two years since it was incorporated a town. Its growth during recent years has been spectacular, the population having increased from 21,000 in 1909 to 70,000 in 1914, and its assessment in the same period from twenty-five and a half millions to one hundred and eighty-eight million dollars. In 1913 the tax rate under the single-tax system was 16 mills. The estimate of building work to be carried out during 1914 is ten million dollars—rather more than four times the actual value of the building work done in 1909. This season there will be an expenditure of $1,125,000 on paving, $77,328 on concrete walks and $642,500 on sewers. The city has 41.61 miles of paved streets, 27.92 miles of boulevards, 100 miles of graded roads and 335 miles of unimproved roads. There are 120 miles of sewers. The extensions planned for the present year comprise a total of approximately forty miles at an estimated cost of $2,000,000. A trunk system is under construction, this being built entirely in tunnel varying in depth from 40 ft. to 100 ft. below the ground surface. The tunnel system discharges into the Saskatchewan river through a 10 ft. 6 in. sewer. The latter is constructed of concrete blocks, around the outside of which when built into the sewer, is placed a steel band. About eight miles of this type of sewer have already been constructed, with satisfactory results. The sewerage is a combined system as far west as 21st Street. West of this a separate system is employed, the sewage being discharged into the North Saskatchewan River. At one outlet the sewage discharges into a separate tank. Garbage is disposed of by incineration. The water supply is from the North Saskatchewan River, the water being pumped by low lift pumps to a filtration plant, the filtered water being pumped directly into the distribution system by low lift centrifugal pumps to a sedimentation basin, and thence through a gravity mechanical filter to the reservoir. After being treated with hypochlorite of lime, it is pumped by service pumps into the distribution system. The street railway system, like all the other utilities, is municipally owned. During 1913 an extensive programme of track construction was carried out. Extensions to the electric light system will be made this season at a cost of $152,000.

High River, Alta.

Incorporated eight years ago this town has a population of 1,500 as compared with 1,000 in 1909. The assessed valuation of the town is $1,335,000. The combined expenditure on building and engineering work this season will be $60,000. The town has five miles of graded roads, upon which $50,000 will be expended in improvements this season. A sewerage system discharging into the river is now under construction. Extensions to the system are planned at a cost of $5,000. The garbage is collected and deposited on a nuisance ground. The water supply is from the Highwood River, the water being pumped to a 160,000-gal. standpipe.

Lacombe, Alta.

This town was incorporated in 1902 and the population figures for 1909 and 1914 are 1,100 and 1,800. The present assessment is $596,000 under the single tax system, and the 1914 tax rate is about 40 mills. No reliable estimate of building and engineering work is obtainable. There are about seven miles of roadways, five of which are earth and two are macadamized. There is no system of sewerage and the garbage is dumped on a nuisance ground. The installation of a waterworks system is contemplated at a cost of about $30,000.

Lethbridge, Alta.

The town of Lethbridge received its charter in 1890 and became a city in 1906. Two years later its population was 6,085, while to-day it is 11,500. The assessment is $17,000,000, as compared with $5,000,000 in 1909. The value of building in the latter year was $1,268,215 and of engineering work $198,000, while the 1914 estimates for building and engineering are $2,250,000 and $258,000 respectively. There are thirty-three miles of clay roads and 1.6 miles of paved roads. Details of classification further than asphaltic concrete, concrete and clay are not given. The city's sewerage system comprises thirty miles of sanitary sewers and three miles of storm sewers. The method of sewage disposal is by sedimentation tanks, sprinkling filters and humus and chlorinating tanks. The garbage is collected by carts and burned on a dump. Paper is burned in a portable incinerator. The water supply is from the Belly River, the water being pumped to two standpipes, and the waterworks system consisting of thirty-six miles of cast iron, wood and steel mains. The installation of a new high pressure system is contemplated at a cost of $80,000. Electric light extensions will be made at a cost of $10,000. The municipal affairs of Lethbridge are administered under the commission form of government.

MacLeod, Alta.

This town was incorporated in 1889, has a population of 3,000 (2,000 in 1909) and is assessed under the single-tax system at $5,000,000. The 1914 tax rate is 13 mills. The 1914 estimate of building work is $150,000. There are twelve miles of macadam and gravel roadways. A combined system of sewerage is in operation, the sewage being discharged into the river. The extensions contemplated comprise sewage disposal and trunk sewer at a cost of $65,000. Garbage is collected and deposited on a dump. The water is obtained from the Old Man River, there being approximately nine miles of mains and fifty-five hydrants.

Medicine Hat, Alta.

Medicine Hat was incorporated as a town in 1899 and as a city eight years later. Its population of 3,500 in 1909 has now increased to 14,000. The tax rate for the present year is 15 mills. The value of building in 1909 was, roughly, $200,000, as compared with the 1914 estimate of $3,000,000. The 1914 estimate of engineering expenditure is $660,000, compared with an expenditure of $60,000 in 1909. The city has twenty-five miles of macadam and gravel roadways, upon which there will be an expenditure of $60,000 this year. A separate system of sewerage is in operation. The surface sewer system is to be extended at an estimated cost of $90,000. There is no method of disposal. Garbage is collected in carts and dumped. The water is taken from the Saskatchewan River and filtered mechanically. The waterworks extensions planned involve an expenditure of $120,000, divided equally between plant and distribution. Extensions to the electric light system will be made this year at a cost of $60,000. The reader need hardly be reminded that one of Medicin Hat's main assets is its natural gas, which is sold to the domestic consumer at 13½c net and to the manufacturer at 5c net. The electric light and power plant is municipally-owned.

Raymond, Alta.

The town of Raymond was incorporated in 1903. Six years later its population was 1,700, which has now increased to 2,000. The 1914 tax rate is 30 mills and the estimate of building work is $75,000. There are twenty-five miles of earth roads. There is no sewerage system, neither is there any method of garbage disposal. The water supply is obtained from a well.

Redcliffe, Alta.

Although Redcliffe came into existence as a town as recently as 1912, it has a population to-day of 3,000. The assessment for 1914 is in the neighborhood of $7,000,000. The figures regarding tax rate and building for 1914 are not available, but the expenditure on engineering work this season is estimated at $250,000. Plans are in course of preparation for a system of sewerage. The garbage is collected by contract and burned. The water supply is from wells near the South Saskatchewan River, the water being pumped into a steel water tank having storage capacity of 300,000 gals. A scheme is under consideration for extending the waterworks four miles, with house connections and meters at an estimated outlay of $75,000. The town is lighted by natural gas.

Red Deer, Alta.

Incorporated as a town in 1901 and as a city in 1913, Red Deer has a population of 3,500, an assessment of [illegible] and a tax rate of 15 mills. The value of building for 1914 is estimated at $150,000 and engineering work will cost $15,000. On street and roadway improvements this season the sum of $3,000 will be expended. There is a combined system of sewerage, the sewage being discharged direct into the Red Deer River. Extensions to the system will be made at a cost of $75,000. The water supply is from the Red Deer River, the water being pumped into mains from a gravity filtration plant.

Stettler, Alta.

The population of this town, which was incorporated in 1908, has increased from 1,200 in 1909 to 1,800 in 1914. The assessed value of the property is roughly $1,000,000. The tax rate for 1914 will probably be 28 mills. The town has 20 miles of graded roads upon which an expenditure of $1,000 will be made this season. The garbage is collected by scavengers and deposited on a nuisance ground. The water supply is from wells, the system including an elevated tank. Waterworks extensions projected will cost $1,500 and electric light extensions $1,000.

Taber, Alta.

This town was incorporated in 1907. It has a population of 3,000 and was assessed last year under the single tax system at $1,285,000. The 1913 tax rate was 38 mills. There are no municipal improvements in the way of roads or sewerage. The water suply is from the Belly River. Waterworks extensions are planned at a cost of $15,000.

Vermilion, Alta.

This town was incorporated in 1906. Its population is 1,250, which is double that of five years ago. The 1914 assessment is $1,723,357 and the tax rate 29 mills. The value of building work this year is estimated at $75,000 and of engineering work at $2,000, the latter sum covering preliminary expenses for sewerage and waterworks. There are three miles of graded roads. About $5,000 will be expended on road work this season.

Wetaskiwin, Alta.

Incorporated as a town in 1902 and as a city four years later, Wetaskiwin has a population of approximately 3,500. The assessment for the present year is estimated at $3,650,000. The tax rate in 1913 was 22¾ mills. There are about nine miles of earth roads in the city. Concrete sidewalks are laid through the entire business section, and extensions estimated to cost $2,500 are on the 1914 programme. A combined system of sewerage is in operation. The sewage disposal plant is located less than four miles east of the city, the Owens live earth bed system being employed. Sewerage extensions will be made at a cost of $6,000. The garbage is deposited on a nuisance ground and burned. The water supply is obtained from three wells, the water being pumped by compressed air to a concrete reservoir of 212,000 gals. capacity, thence by gas or steam pump to an elevated tank of 120,000 gals. capacity.

British Columbia

Armstrong, B.C.

Armstrong was incorporated in 1913. The town has a population of 1,400, an assessment of $860,000 and a tax rate of seventeen mills. The building programme this season is estimated to total in value $30,000. There are twenty miles of gravelled roadways, upon which an expenditure of $50,000 is planned. The water supply is from Davis Creek.

Cranbrook, B.C.

Cranbrook was incorporated in 1905 and has a population of 3,500, with an assessment of $2,000,000. The 1914 tax rate is 28 mills. It is estimated that $12,000 will be spent on municipal engineering work this season. There are 12½ miles of earth and gravel roads and $9,300 will be expended on road work this season. The sewage is filtered and the effluent discharged into St. Joseph's Creek. Garbage is deposited on a dumping ground. The water supply is from St. Joseph's Creek.

Fernie, B.C.

This city was incorporated just ten years ago. It has a population of 5,500, the increase in recent years having been small. The 1913 assessment was roughly $2,700,000 and the tax rate 24 mills. In 1909, following a disastrous fire which practically consumed the city, the value of building was approximately $1,500,000 and of engineering work $120,000. The 1914 estimate for building is $30,000 and for engineering work $11,000. The city has eleven miles of roads, with no permanent pavements or macadamized highways. An expenditure of $10,000 on road work is contemplated. A separate system of sewerage is installed, the method of disposal being septic tanks. The city limits are practically all sewered, with the exception of a small residential district, the sewers for which are estimated to cost $14,000. No extensions will be made this season. Garbage is deposited on a dumping ground and burned. The water supply is from Fairy Creek. A concrete dam has been built across the Creek and the water is led from the reservoir thus formed by a 12-in. wooden main to the city. The length of main from the reservoir to the centre of distribution is three miles. The storage reservoir, which is close to the city, has a capacity of 750,000 gals. The electric light system is to be enlarged this season at a cost of $9,000.

Kamloops, B.C.

This city has just attained its majority, it having received its charter in 1893. Its population to-day is 6,000—the figures having doubled in the last five years, during which period the assessment has increased from $130,000 to nearly six millions. The tax rate this year is 24¾ mills. The building expenditure in 1909 was $37,000 and the engineering expenditure $10,000, and the 1914 estimates are $425,000 and $60,000, respectively. The roadway mileage is 30. All the roads are earth, but permanent types are now under consideration. The estimated expenditure on road work this season is $3,000. The sewerage is a separate system, the method of disposal being by septic tanks. A scheme to embrace the sewerage of the whole city is under consideration. In this department there will be no expenditure during 1914, but next year there will probably be an outlay of $10,000. The city has adopted no system of garbage collection and disposal, but incineration is under discussion and a scheme will probably be brought forward next year. The city derives its water supply from the South Thompson River. The waterworks, as installed, provide for future filter beds. The main undertaking at present is the completion of a hydro-electric power plant, the total cost of which has been over $400,000. The matters which will come up at Kamloops next season and in subsequent years may be enumerated as follows: permanent roads; sewerage of east end; sewage disposal plant for the whole city; waterfront improvement; filtration plant.

Ladysmith, B.C.

Incorporated just ten years ago, this town has a population of 3,500. The assessed value of the property is one and one-quarter millions, and the estimate of the building work to be carried out this season is $500,000. There are ten miles of gravel roads. The sewage is discharged into the harbor, there being ten miles of mains. Minor extensions to the sewerage system are planned. The garbage is collected by teams and there is no method of disposal other than dumping. The water supply is from Stocking Lake. The waterworks system is owned by the E. & N. Ry. Waterworks Company. Improvements to the electric light system are to be effected at a cost of $4,000.

Nanaimo, B.C.

This city of 9,000 inhabitants was incorporated just forty years ago. Its population has increased 2,000 during the last five years. The assessment is roughly seven and one-half million dollars, and the tax rate for the year is 32 mills. There are 16½ miles of paved streets and macadam roads. In the way of road work, asphaltic concrete is planned this season at a cost of $220,000. The sewerage is a separate system, the sewage discharging into the harbour. There are about ten miles of sewers. This season the system is to be completed by the addition of about six miles at a cost of $75,000. From the Nanaimo River water is brought in sixteen miles by gravity. Waterworks extensions planned total $50,000. The electric light system is owned by the Nanaimo Electric Light, Power & Heating Company, Limited. The system is to be enlarged by two miles of pole line.

Nelson, B.C.

Nelson was incorporated in 1897. The city has a population of 7,500 and an assessment of $4,320,896. There are over sixteen miles of streets, most of which are earth, only one-half mile being macadam and two miles gravel. The sewerage is about nine miles in extent and discharges into the lake. The city collects the garbage, which is disposed of on a dump. The source of the water supply is Cottonwood Creek and Anderson Creek.

New Westminster, B.C.

The city of New Westminster was incorporated in 1861. Its present population is 17,178 and its assessment, roughly, $17,000,000, as compared with a population of 10,000 and an assessment of $5,000,000 in 1909. The 1914 tax rate is 20 mills. This year the building work is estimated to cost $850,000 and the municipal engineering work $600,000. The mileage of roadways for the whole city is 98, classified as follows: Bitulithic, 3.50; Hassam, 3; granite setts, .50; wood block, .30; vitrified brick, .30; macadam, 30; balance, rough-graded. The sewerage system consists of 43 miles on the separate system and 6½ miles of storm sewers. The method of disposal is by dilution into the Fraser River. The sewerage extensions contemplated involve an additional forty-five miles of combined sewers, the total cost of which will be $850,000. At the time of writing, contracts have been let for $200,000 worth of work. The combined sewer which is being constructed is divided into two watershed areas, one of which is approximately 1,300 acres, of which 650 lie within the boundary of the Burnaby municipality. The size of the out-fall for this scheme is 8 ft. by 6 ft. 6 ins. and is composed of reinforced concrete monolithic sewer, horse-shoe shaped in section. This will be built practically following the line of the existing Glen Brook, which it will eventually absorb. This section will be constructed partly in a ravine and is designed to withstand a new fill forty feet in height. Three thousand feet of this section will be built through the Penitentiary Reserve. The total discharge at the out-fall is calculated at 610 cu. ft. per second. The smaller watershed area of the Sapperton sewer, No. 2, comprises an out-fall of two 48-in. reinforced concrete pipes, to be manufactured by the Pacific Lock Joint Pipe Company. Before reaching the Fraser River, the point of discharge, a small creek known as the Brunette Creek, some fifty feet in width, has to be crossed by an inverted syphon. Before this syphon is reached, a large grit chamber is to be constructed, so that the grit can be handled at this point before reaching the syphon. Garbage is collected in wagons and disposed of partly in a small incinerator, the bulk, however, being dumped from scows into the sea. The water supply is from Lake Coquitlam, a pure mountain supply with no filtration required. The water is brought through 14 miles of 14-in. steel mains and 14 miles of 25-in. steel mains from the lake to the city. The maximum discharge from both mains is 8,000,000 gals. a day. The maximum head at lake is 503 feet and the highest reservoir in the city is 398 feet. This season it is planned to build a new reservoir and make other extensions, the whole to cost $75,000.

North Vancouver, B.C.

North Vancouver is a seaport town on the north shore of Burrard Inlet, opposite Vancouver. The city was incorporated in 1907 and has a population of 10,000. The assessment is rather more than $16,000,000. This year it is estimated that $300,000 will be expended on building work and a similar sum on engineering work. Tenders have been received for a bridge across the Second Narrows (between Vancouver and North Vancouver) estimated to cost $3,000,000. The roadway mileage is 60, made up of 13.5 miles of macadam and the balance earth. The expenditure on road work this season will be $75,000. Sanitary and storm sewers have been installed and the sewage runs into the deep water of Burrard Inlet. Sewerage extensions are planned at a cost of $35,000. Garbage is collected by teams, dumped and burned on tide flats. The water supply is by gravity from Lynn Creek, the water being brought into the city through a 16-in. main from an intake placed five miles above tide water. The side mains are partly of wood and partly of cast iron. The extensions planned comprise the erection of the Rice Lake Reservoir (capacity 150,000,000 gallons) at a cost of $175,000, of which, at the time of writing, $110,000 has been expended. North Vancouver, which is situated on the main line of the Pacific Great Eastern, has ten miles of first-class waterfrontage.

Port Alberni, B.C.

Port Alberni, which was incorporated in 1912, has a population of 1,100 and is assessed at $3,500,000. The building estimate for the season is less than $100,000, while the expenditure on streets, bridges and waterworks will be $15,000. The 1913 tax rate was thirteen and one-half mills. The town has twenty miles of gravel roads and the sum of $6,000 will be expended in road work this season, chiefly on sidewalk construction. Garbage is collected and buried. The water supply is from China Creek.

Prince Rupert, B.C.

The city of Prince Rupert was incorporated just four years ago and its population to-day is rather more than 6,000. The 1914 tax rate will be between 13 and 15 mills. The building permits issued to date amount to half a million dollars, while the estimate for the year is $2,500,000. The estimated cost of the completion of important undertakings is detailed as follows in the last annual report of the President of the Prince Rupert Board of Trade: Grand Trunk Pacific Railway: dry dock, $2,750,000; fifteen-storey hotel, $2,000,000; terminal facilities, docks, depot, shops, etc., $2,500,000. Dominion Government: post office, $250,000; quarantine station, $100,000; armory, $100,000. Provincial Government: courthouse and administration office building, $300,000. City Council: hydro-electric plant, $380,000; sewerage system and waterworks extensions, $500,000; section two bridge, $100,000. Imperial Oil Company: five large storage tanks, $200,000. Total, $9,180,000. Prince Rupert has 13 miles of plank roads, 7 miles of graded roads, and 7 miles of planked sidewalks. The expenditure on road work this season will be $[illegible]. The sewerage system consists of about three miles of vitrified pipe and wood stave sewers. The sewage empties into the harbor. Sewerage extensions planned involve an expenditure of $350,000. Garbage is collected by carts, loaded on a scow, and dumped into the sea. The installation of an incinerator is proposed. The water supply is by gravity and pumping from Hays Creek, Woodworth and Shawatlans Lake. The extensions planned (now under way) comprise the completion of the hydro-electric system and distribution system at an estimated cost of $[illegible],000. Electric light extensions now under way, at a cost of $185,000, consist of a power house, pole line and distribution system. Further extensions will cost $60,000.

Revelstoke, B.C.

Revelstoke received its charter of incorporation as a city in 1899. It has a population of 4,000 and an assessment of $3,181,503. Building work for 1914 is estimated to total in value about $1,700,000, the estimate for engineering work being $16,000. There are three miles of cement sidewalks but no permanent streets. There is a gravity system of sewerage in operation, the outlet being into the Columbia River. The city's water supply is derived from mountain streams. It is proposed to expend $40,000 on the electric light system.

Salmon Arm, B.C.

This town was incorporated as recently as March, 1914. It has a population of about 1,000, an assessment of nearly $862,000 and its tax rate last year was thirteen mills. The building and engineering programme for the present season is estimated to involve outlays of $250,000 and $12,000 respectively. There are ten miles of common roads. The water supply is from East Canoe Creek and the extensions planned will cost $10,000.

South Vancouver, B.C.

The municipality of South Vancouver has a population of 40,000 and is assessed at rather more than $34,000,000, the assessment having increased from $6,500,000 since 1909. The expenditure on building work last year was $1,750,000. The area of the municipality is fourteen and a half square miles. In regard to street improvements the following mileage statistics may be found of interest: streets in municipality, 246.5; cleared and rough graded, 204; uncleared, 42.5; macadamized, 35.4; paved roadways, 3.84; planked roadways, 12; sidewalks made, 117.83; street car lines, double track, 4.57; street car lines, single track, 6.02; single track interurban railway, 4.7; double track interurban railway, 2.08; wooden box drains and culverts, 13.14; sewers laid, .15; storm sewers laid, 2.5; concrete curb only laid, .24. Main Street is now being paved with wood blocks on 6-in. concrete base to the extent of 32,500 square yards, at a cost of $3.33 per square yard, including excavation. Estimates are being prepared with a view to obtaining a water supply of 3,000,000 gallons a day from the city of Vancouver, or as an alternative, inaugurating a water supply scheme from Seymour Creek where the Water Board of the B. C. Government have alotted them 550 miners' inches. At the present time, a steel storage tank, 75 ft. high and 50 ft. in diameter, is being constructed at Central Park at a cost of $30,000. The sewerage system will be included in the Burrard Peninsula Joint Sewerage Scheme, comprising the city of Vancouver and the municipalities of South Vancouver, Point Grey and Burnaby. Plans, specifications, etc., are in course of preparation for the sewerage scheme. The Board of Health has under consideration the installation of a garbage incinerator.

Vancouver, B.C.

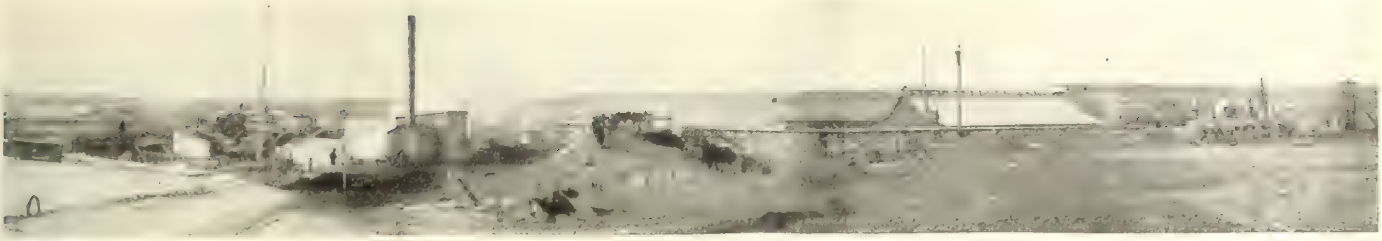
This city, which has an area of 16.89 square miles, was incorporated in 1886. The population is 122,000, an increase of 43,000 in the last five years, during which period the assessment has increased from $73,000,000 to $227,000,000. The 1913 tax rate was 20 mills. The value of building permits for 1909 was seven and a half million dollars, while the 1914 estimate for building work is $10,000,000. The engineering expenditure five years ago was $2,000,000—about half the estimated outlay for 1914. The city has 51.479 miles of permanent pavements of the following classes: asphaltic concrete, bitulithic, sheet asphaltic, creosoted wood block, granitoid, Hassam, concrete and vitrified brick. In addition there are 171 miles of macadam streets and lanes and also in the more recently settled portions there are many miles of planked roadways, this class of construction being adopted as the cheapest and quickest method of giving access to property. At the present time there are [illegible] miles of cement concrete sidewalks in the city. Upwards of 30 miles of macadam streets are annually oiled to mitigate the dust nuisance, this practice ensuring first-class thoroughfares for motor traffic. In addition to the old type pressure flushers, two 8-ton 1,200-gallon flushers were put in service last year, thus allowing for the daily flushing of all permanent pavements. During the present year there will be an expenditure of $1,320,000 on road work, this amount being apportioned as follows: pavements, $800,000; cement sidewalks, $100,000; grading, planking, etc., $350,000; and general improvements, $70,000. A combined system of sewerage is employed, the sewage discharging into the sea. To date the total mileage of sewers is 170. In the last few years large storm water sewers of the horse-shoe type have been constructed. The largest has a width of 11 ft. 4 in. and a height of 9 ft. 1 in. Last year the provincial government passed a special act for the purpose of forming a Joint Sewerage Commission, under whose authority all future construction of trunk sewers will be carried out. This Commission has jurisdiction over Vancouver city, and the municipalities of Point Grey and South Vancouver. During 1914 the sewerage extensions planned will involve an expenditure of $2,000,000, in addition to the large construction work to be undertaken by the Joint Commission. The city operates two large incinerators for the burning of garbage, the garbage and ashes being handled separately, the latter being dumped. The water supply is brought by gravity from Capilano and Seymour Creeks, both glacier-fed streams. The Vancouver water supply is brought across Burrard Inlet by means of six 12-in. pipes, 1,600 ft. long; one 18-in. pipe, 2,200 ft. long, and five 18-in. pipes, 1,100 ft. long—all of the cast-iron flexible type. These are laid on the bed of the Inlet, the lengths given being of the submerged portions. Last year the city gave to the Canadian Northern Pacific Railway that portion of False Creek known as the City Reserve. On this land is to be erected the Pacific terminal of the Canadian Northern Transcontinental Railway. The passenger station, with necessary offices, will cost not less than $1,000,000, while the total expenditure will be some $4,000,000, exclusive of hotel. Provision is made for the establishment and maintenance of deep water wharfage and facilities adequate to the needs of a transcontinental railway and a trans-Pacific steamship line. The Great Northern Railway have a similar agreement with the city and work on both schemes is at present being carried out. At the present time the Canadian Pacific Railway is expending over three and a half million dollars in constructing a new terminal station and hotel. Tenders were called a few months ago for the erection of the Second Narrows bridge, which will form a link between Vancouver city and the city of North Vancouver, crossing Burrard Inlet. When erected, this bridge will connect the Pacific Great Eastern Railway with Vancouver city. The Dominion Government is proceeding with the construction of a dock on Burrard Inlet, the estimated cost being $1,250,000. Extensive dredging operations are being carried out at False Creek by the Dominion Government for the purpose of creating a deep water channel to the combined railway terminals at the head of the Creek, and a considerable amount of dredging is under way in the First Narrows, at the entrance to Burrard Inlet. Another large undertaking upon which work is advancing steadily is the Georgia-Harris Viaduct, which is being constructed of reinforced concrete (mushroom system), the amount of the contract being $455,000.

Vernon, B.C.

This town, or rather city—every town in British Columbia being a city—was incorporated in 1892 and now has a population of 4,000, an increase of 1,500 in the last five years. The 1914 assessment is rather more than four millions, as compared with one-and-a-half millions in 1909. The estimate for building work this year is, roughly, $1,500,000, and for engineering work $8,000—considerably more than double the corresponding expenditures five years ago. The 1914 tax rate is six mills. Vernon has a roadway mileage of 78, of which five are macadamized and 73 are gravelled. The sum of $10,000 will be expended on roadwork this season Sewage disposal is by septic tank and Stoddart percolating filter. The sewerage extensions planned comprise storm sewers, with addition to the disposal works, the whole costing $65,000. Garbage is collected by teams and deposited on a nuisance ground. The water supply is from a creek and is distributed through twenty-eight miles of mains (cast iron, steel and wood). There are two reservoirs having a capacity of 1,600,000 and 5,000,000 gallons respectively. Extensions to the electric light system are planned at a cost of $50,000.

Victoria, B.C.

This city, whose present population of 50,000 has more than doubled in the last five years, and whose assessment of $115,960,000 has quadrupled in the same period, received its charter in 1862. The value of building work in 1909 was rather less than $2,000,000, in 1912 $8,200,000, and in 1913 $4,000,000. The expenditure on engineering enterprises in 1909 was a little less than $700,000, while the estimated outlay for 1914 was $2,900,000, inclusive of the Sooke Lake water scheme. The roadway mileage is 146, classification being given as follows: unimproved, 79¾; asphalt, 47½; wood block, 3½; concrete pavement, ¾; boulevard, 57; macadam, 12½; tar macadam, 1½; vitrified block pavement, ½; concrete sidewalk, 123. The city is continuing the practice of carrying out its own sidewalk construction and has decided this year to do all grading, construction of curbs, gutters, and laying of concrete base by day labor, letting the contract for the laying of sheet asphalt. Next year, however, it is the intention to erect an asphalt plant so that all paving work will be carried out by the city. With the exception of building construction very little municipal work is let by contract. The sewerage is the high level gravity system, the low level sewage being pumped to high level and syphoned across to gravity outfall. The sewage is discharged into tidal waters. In this department the extensions planned this year will cost $480,000. All sewer construction work is done by the city by day labor. In this connection rapid progress is being made on the construction of the northwest trunk sewer system, the completion of which will drain an area of about 425 acres in the residential section of the city, as well as 1,000 acres in Esquimalt and 800 acres in Saanich. This work will involve an expenditure of $390,000, a feature of the scheme being heavy tunnelling work to the extent of 7,250 ft. through solid rock, and 3,100 feet of trenching, much of which is also through rock. The sewer will be constructed of reinforced concrete pipe, varying in diameter from 27-in. at the start to 36-in. at the outlet, the pipe being manufactured in 5-ft. lengths. Garbage is collected in dump carts and delivered to sub-stations, re-collected by motor truck, dumped on scows, and towed to sea under contract. The city's water supply is obtained from the Esquimalt waterworks. The Sooke Lake dam, Humpback reservoir, and grading and concrete trestles for flow line were constructed by the city and the contract let to the Pacific Lock Joint Pipe Company for the manufacture and laying of reinforced concrete pipe for flow line. The contract was also let to the Burrard Engineering Company for the construction of the rivetted steel pressure line from Humpback reservoir to the city, all trenching and back-filling on the latter to be done by the city. This scheme, the estimated cost of which is about $3,000,000, is in process of completion Extensions to the city mains will be made this season at a cost of $50,000.



Owing to the shortness of time, all parts of the work were carried on simultaneously. [Swift Current Storage Dam]

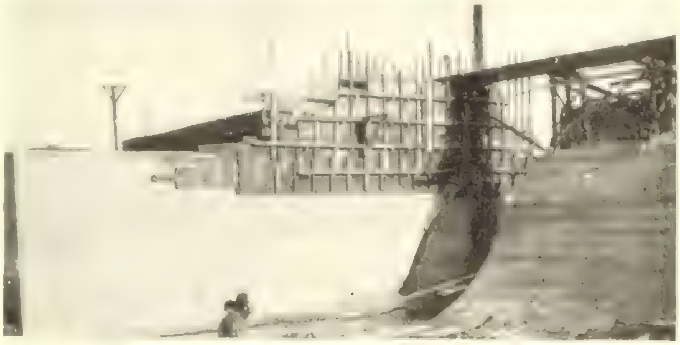
Reinforced Concrete Storage Dam at Swift Current, Sask.

By W. F. Farley[*]

In the winter of 1912 the water supply at Swift Current, Sask., failed completely, owing to the freezing of the Swift Current Creek from which the supply was obtained. In order to prevent a recurrence of such a catastrophe, the Swift Current officials decided that it was absolutely essential that a reliable water supply should be secured before the coming of another winter.

As Swift Current Creek is the only available source of supply in the immediate vicinity, the problem resolved itself into damming this creek and forming a reservoir of sufficient capacity to tide over the comparatively short period during which it might be possible for such a condition to recur. The foundations throughout the length of this creek are suitable only for the construction of a hollow dam, and as the city was desirous of obtaining a permanent structure, it was decided, after considerable preliminary investigation, to use the Ambursen type of spillway, together with corewalls and earth embankments at either end. A design for such a dam was therefore prepared by the Ambursen Hydraulic Construction Company of Canada, Limited, in conjunction with the city officials.

No reliable data regarding the maximum flow of the stream was available. It was necessary, therefore, to provide a large factor of safety for the discharge capacity of the dam. At either end of the spillway section the earth embankment is retained by means of a cantilever retaining wall of reinforced concrete construction. At one end of the spillway section an intake is provided within which the water passes alternately through coarse trash racks and fine copper screens before it enters the pipe leading to the pumping station. Gate valves provide for the absolute control of the water as it enters the pipe, these gate valves being controlled from a gate house placed directly over the intake.



Considerable care was taken in providing for proper concrete surfaces.

The results of borings indicated the necessity for the excavation of a considerable amount of material, in order to obtain a suitable foundation for the spillway. Cut-offs are provided around the area occupied by this spillway and also under the concrete corewalls

Concrete was placed by means of a derrick with the aid of chutes and cars.

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[*] Assistant Engineer, Ambursen Hydraulic Construction Company of Canada, Limited

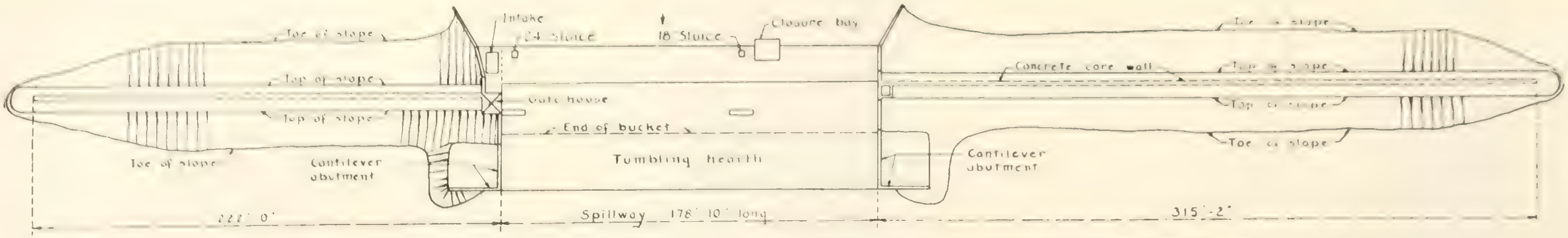
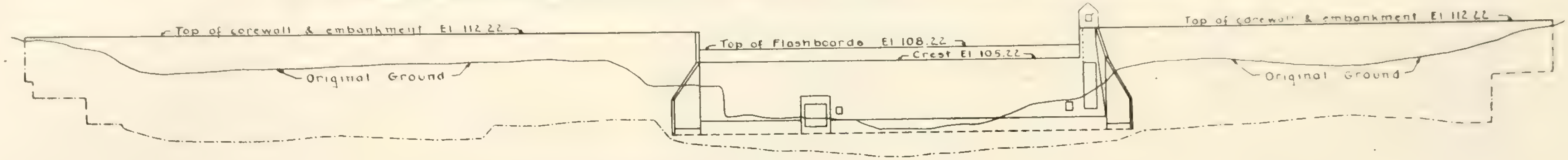


Fig. 1—The dam consists of reinforced concrete spillway, on either end of which there is a concrete core-wall and earth embankment.


Top of corewall & embankment El 112.22
Original Ground
Top of Flashboards El 108.22
Crest El 105.22
Top of corewall & embankment El 112.22
Original Ground

Fig' 2—Flashboards provide for an increase of 3 ft. in normal level of reservoir.

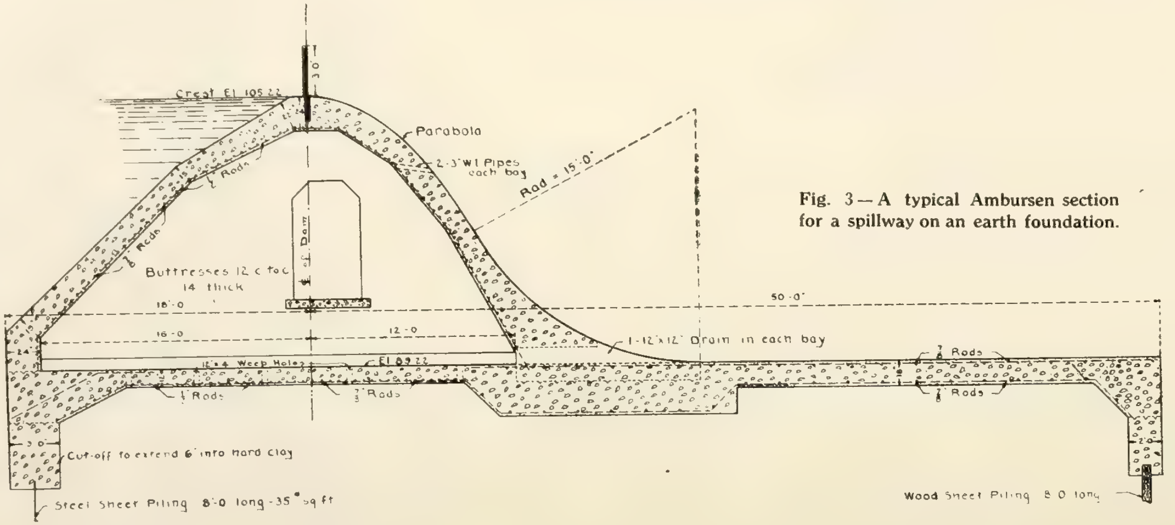

Crest El 105.22
3'-0"
Parabola
2-3" W.I. Pipes each bay
Rad = 15'-0"
℄ of Dam
Buttresses 12 c to c 14 thick
18'-0
16'-0
12'-0
50'-0"
1-12"x12" Drain in each bay
Weep Holes
El 89.22
Rods
Rods
Rods
Rods
Cut-off to extend 6' into hard clay
Steel Sheet Piling 8'-0 long-35# sq ft
Wood Sheet Piling 8'-0 long

Fig. 3—A typical Ambursen section for a spillway on an earth foundation.

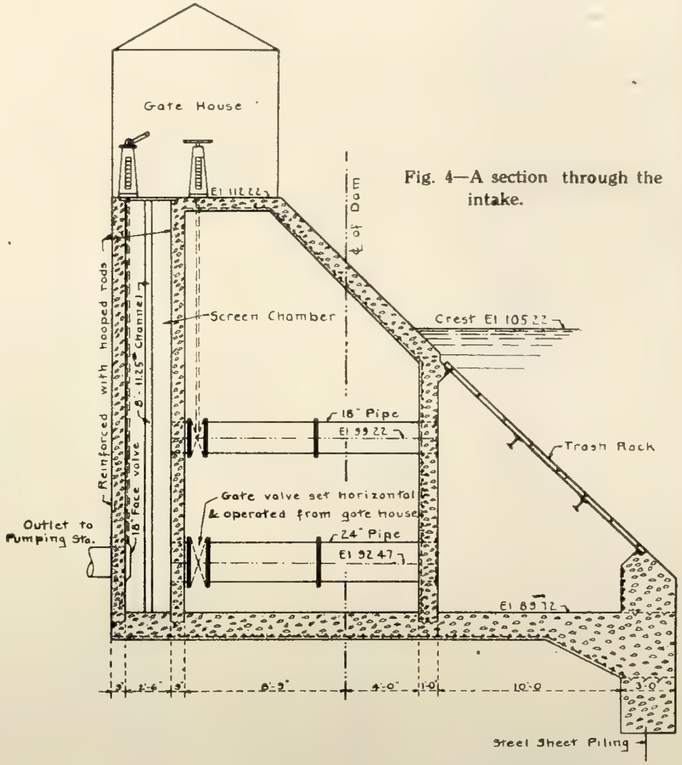


Fig. 4—A section through the intake.

Reinforced Concrefe Storage Dam at Swift Current, Sask.

The flow of the creek was handled by means of a small wooden flume. [Swift Current Storage Dam]

at either end. These cut-offs consist of concrete to a depth of 6 inches below the surface of a blue clay substratum. Into this blue clay was driven sheet piling to further diminish the possibility of seepage beneath the dam. A tumbling hearth is provided of sufficient length to prevent any possibility of scour due to the passage of the flood water over the dam.

Owing to the financial stringency during the summer of 1913, the city officials found it impossible to secure the necessary funds for the construction of this dam until late in the summer. Finally they succeeded in their efforts, however, and construction was commenced by the aforesaid company during the first week in August.

The time factor involved was largely instrumental in deciding the question of the proper plant to be used on this work. This problem was solved very successfully by the shipment of a Guy derrick, mixer, pumps, boilers, etc., which had just been thrown out of employment by the temporary closing down of construction work at LaColle Falls, near Prince Albert, Sask. This plant arrived on the site on the 20th of August and was put into operation as soon as possible.

The cofferdam problem was solved very easily by means of a small "A"-frame dam, constructed of timber and toe-filled with part of the material excavated from the site of the dam. This cofferdam was pumped out for the first time on August 23rd, thus preparing the way for the excavation in the middle of the creek. The excavation was started on August 26th.

The first concrete was poured in the cut-off trenches on September 25th, and from that time on the dam grew day by day until the 3,500 cu. yds. of concrete had been placed. The dam was finally closed on December 23rd and the water allowed to collect behind it. On December 24th the dam was officially turned over to the city.

The Efficiency of Water-Works Devices[*]

By E. L. Loomis

MORE than four-fifths of all the water plants of the state of Indiana belong to the smaller classes, whose daily pumpages probably average less than one million gallons. As compared with the larger systems, these enterprises have relatively few consumers, limited revenues, and proportionately much higher fixed charges and operating expenditures. Therefore, it is easy to realize that of the problems confronting such utilities, those related to economy and efficiency are of paramount concern. And the smaller the utility, all the greater becomes the necessity for the closest scrutiny into its plant operations for the detection and stoppage of waste, and for the economical conduct of its affairs generally.

So many and varied are the equipments available now-a-days which make for economy that to undertake a minute enumeration and description of them all would much overstep the requirements of this report, not to mention the writer's lack of knowledge as to so wide a range. Only a few items, therefore, will be here considered, chief of which may be cited the pumping machine.

As illustrating an experience in pumping economy you will permit me to state the conditions as existing in our plant at Valparaiso, and to make a comparison of the costs of operating each of our three different types of pumps.

Our pumpage approximates one million gallons per day, pumping direct against a total head of 85 feet. Our principal pump for continuous operations is a cross-compound, condensing engine, with Meyer gear and attached air pumps. Upon acceptance test when we purchased this machine two years ago it showed a duty of 78.57 million foot pounds per 1,000 pounds of steam used, pumping against our usual head at normal load.

Assuming an apparent evaporation of seven pounds of water to each pound of coal, and a total head of 100 feet, with a working duty of about seventy million foot pounds per 1,000 pounds of steam, this machine will pump and deliver one million gallons of water each day for one month at a steam consumption of 358,071 pounds, thus requiring 25.57 tons of coal, which, at

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[*] Abstracts from paper before Indiana Sanitary and Water Supply Association.

$3.50 per ton in bin, costs us $89.49. With our No. 2 reserve pump, of the non-compound, condensing, crank and fly-wheel type, assuming a working duty of only fifty million foot pounds, which really is a trifle too high for the same pumping operation, 501,300 pounds of steam would be consumed, requiring 35.80 tons a coal at a cost of $124.30. With our third unit, a simple duplex pump, which, needless to state, is rarely placed in service, 752,129 pounds of steam would be used, or 53.71 tons of coal, costing us $187.98.

Thus is it observed that by using our No. 1 pump, for each month we operate, we show a saving of $34.81 over pump No. 2, while over pump No. 3 we effect a saving of $98.49, or in round numbers at the rate of almost $1,200 per year.

Such a saving to any small plant in a comparatively short time would be sufficient to buy and install the very best and most economical type of pump which the market affords.

In our own case it is plainly apparent that from the standpoint of even ordinary business economy we had better consign both of our low duty pumps to the scrap-pile rather than place them in continuous operation. As auxiliary units, for temporary emergency purposes, however, they, of course, have their proper place and value.

The pumping machine for every plant should be designed so as to give the best possible economy at the normal load, but with ample capacity for the maximum requirements, such as the sudden opening of large connections, or where direct fire pressure is furnished at the hydrant nozzle. In most all cases operating economy should be considered in making a selection rather than first cost. But the fixed charges on a high duty machine of the Corliss type, by reason of its higher first cost, the greater housing space required and its many complications, may sometimes more than counterbalance the saving over a simpler type, such as the Meyer gear.

The kind of boilers, the character of fuel, and methods of firing are all-important questions in considering boiler room economies. For every plant the boilers should be in duplicate units, and, like the pumps, of ample capacity for the peak load, though not too large for the normal uses. As safeguards, the steam lines from the boilers to each pumping unit should be as nearly separate as possible. Obviously also should the boiler feed-water system be entirely separate and independent.

In determining the kind of coal to be used it has been our experience that dependence should not be placed upon the basis of heat units alone, but that the coals should be tried out, not merely for a few days under the most favorable firing conditions, but thoroughly tested under the every-day working conditions just as they actually exist. Under such test, the coal evaporating the most water for the dollar manifestly should be the kind to adopt. Moreover, with propriety, and sometimes with profit as well, coal bought on contract may be tested from time to time as a check upon its continued good quality. For this purpose where the amount consumed will not warrant the purchase of a good bomb calorimeter, the lead oxide reduction method may be used, such an outfit costing but a few dollars and the results being sufficiently satisfactory for purposes of comparison.

Where the coal storage room is located adjacent to railroad siding, if used in quantities sufficient to justify, coal conveying machinery may effect a substantial saving over the usual hand operations.

As aids in the work of full conservation, involving, as it does, one of the most conspicuous items in operating costs, the best patterns of shaker and dumping grates, and also automatic damper regulators, may be used with profit. If the amount of coal consumed will not justify the purchase of a CO_2 recorder, a boiler efficiency meter with Orsat apparatus will be found to furnish a valuable guide.

Steam flow meters may be had at small cost for attachment to the different steam lines, and when installed will furnish desirable information as to the amount of steam conveyed to the different units or heating systems. Another device of value, though of much greater cost, is the Venturi meter, which, if placed on the pump discharge line as a check on the engine counter, will often reveal unsuspected pump slippages needing correction.

A common and often unconsidered source of loss in many small plants is leaky valves. A valve reseating machine should be in every power house and by its use every valve kept always in proper repair. Suitable equipments for the various repairs common to all plants from time to time are not only necessary but money-saving assets in times of their need.

Oiling arrangements frequently are not given the attention which their importance would seem to deserve. The system employed should be such that the oils may be saved, refiltered and used again. With such saving they may be used more freely than otherwise, thus safeguarding against hot bearings from time to time, with their consequent annoyance, or possible interruption to the service.

In connection with the operation of filtration systems, a good serviceable laboratory would seem to be indispensable for the necessary tests. Cities without such systems and having water at times of questionable quality will find apparatus for the use of hypochlorite of lime to be an inexpensive as well as most valuable acquisition.

By the use of steam and water pressure recording gauges, if supplemented with accurate hourly notations of coal consumed and water pumped, the engineer and manager are afforded definite knowledge concerning the workings of the plant, and also furnished a permanent record of the same.

So well known is the value of the water meter that it would seem to be superfluous to make mention of it here. And yet the fact remains that in Indiana there are a number of plants operating almost, if not entirely, upon flat-rate bases. As a conserver of water this device is second to none, and its value is closely followed by the meter testing machine. For leakage inspections the detectorphone and pitometer are both widely recommended.

For the office there are many devices worthy of adoption and use, such as the adding machine, the typewriter, addressograph, card indexes, filing apparatus, loose-leaf systems, etc. An accurate map showing definitely the location of all mains, valves and sevice boxes is of inestimable value and should be deemed an indispensable part of every system. A few well-selected technical books and the best waterworks journals will prove to be not only sources of information and pleasure, but of actual profit as well. For articles of especial interest, should one wish to dispense with indexes, a scrap-book might be used to good purpose.

Building Construction in Nova Scotia

Not a Wealthy Province But One With a Future—Antiquated By-laws in Force—Structural Character of the Buildings Now Being Erected

By a Halifax Correspondent of the Contract Record

NOVA Scotia is one of the oldest provinces of the Dominion and perhaps the most backward in the matter of building construction. The authority for this statement is a fair knowledge of what has taken place in building during the last twenty years. Buildings are constructed because of necessity, brought about by various conditions such as increase in population, industrial expansion and fire. Man needs shelter for his family, the manufacturer a place to manufacture his goods, the community a place wherein to worship, and so on.

In industrial development Nova Scotia has never experienced a great boom. There have been one or two flurries in different parts of the province but nothing of a general nature. Her growth has been slow, but perhaps steady. Confederation threw cold water on her prosperity. Since then the call of the west has made great demands on her population. This is demonstrated in the fact that during the last two years Halifax has increased in population only 5,787. Situated as we are on the Atlantic Coast, that is, on the edge of the continent, we are in a poor position for manufacturing, and whilst we are proud of the plants we do possess, they are few and far between. Necessity for building, therefore, has been limited.

There is very little wealth in Nova Scotia. Nothing stamps itself on a country in such a decided manner as does the comparative wealth of its inhabitants. Man builds himself a home, accumulates money, tears the old home down and builds anew. A man is prosperous in business and his premises are significant of the fact, sometimes in size, sometimes in decorative features. A group of men enjoying prosperity join in the erection of a more beautiful church, the community grows and demands a theatre and so on. It happens that we have few fine homes in our entire province—indeed comparatively few costing over $20,000. Our places of business are usually old, and many progressive and well-established firms are doing business in frame buildings. Our churches are ordinary, both as regards exterior and interior, and a great majority are of wood. There is not a modern theatre building in Nova Scotia. Not only is there little wealth in Nova Scotia with which to build, but building itself is high and our standard of workmanship is low. Here the mechanic does a small day's work at a high wage. What do you think of the bricklayer setting up two hundred and fifty bricks a day? I have positive information from two of our contractors that this actually constituted a day's work for certain bricklayers under their employ. This condition hinders building in general and the adoption of better types in particular. The writer has frequently found difficulty in convincing Upper Canadian clients that certain work has been executed by our best men and that the price is not exorbitant, considering the above conditions.

Our building laws are defective. They are not revised so as to keep pace with structural developments, nor are they progressive in the matter of demanding higher and newer ideals. They do not give protection to the individual. You may buy a block of land in Halifax for the purpose of developing a housing scheme, for instance, without any assurance on the part of our building laws that your next door neighbor may buy the adjoining block for factory purposes, or for tenements of the cheapest kind. There is only one street, and a short one at that, where one can go with safety and even here the minimum cost for a home is $5,000. Probably one reason why our building laws are not in a sufficiently revised state is that Halifax has never suffered from fire and her citizens therefore are not afraid of it. You will find the residential portions of our city almost entirely frame, whilst the commercial districts are a strange mixture of wood, brick and stone. Some of our largest hotels and picture theatres are of wood and a constant menace to life. Some day we will be burned out and then our building laws will be revised, demanding the best there is in construction and encouraging development in all its phases. This is the old story of erecting a fence after someone has fallen over the ditch.

It seems singular, too, that such conditions should exist when our province is so amply supplied with building materials. Our timber is exported to all parts of the globe. Our freestone is finding a good market in the upper provinces. Our granite cannot be beaten for quality and texture, and we are at present manufacturing brick which not only compares favorably with those manufactured in other parts of Canada, but we were given first place over Upper Canadian brick at a recent exhibition. We have sand and gravel for concrete work which tests very high, even running a very close race with broken stone for results.

Better Days in Store for Nova Scotia

We are hopeful, however, that a better day is dawning for our city. At present foreign capital is knocking at our doors asking for the opportunity of developing waterways outside our city, so as to bring in cheap power for the purpose of attracting manufacturing plants. A year ago outside capitalists, realizing the possibility of expansion in this territory and the scarcity of property in the small peninsular on which we are built, purchased vast quantities, both suburban and commercial, with the result that our real estate values have been greatly raised. The terminal works which have been started by the Dominion government are bound to revolutionize the life of our city. The facilities for shipping which will be thus afforded will be unsurpassed on the Atlantic Coast and cannot fail to attract steamship lines to our port, thus making us the so-called "Gateway of the Dominion." We are hoping that this will apply not only to passenger traffic but that a great freight trade will also result. The Dominion government is also contemplating, and we have been given to understand have decided upon, the erection of a new dry dock such as will accommodate the largest ship afloat. We were informed not long ago that British capital was being interested in the matter of a ship building plant, locomotive works, and other industrial enterprises for our city. If half these good things could only be realized we would be more than satisfied, for our city would then awake from its slumbers, new blood and fresh life would be enthused in its veins and Halifax would eventually become, as we had hoped some day it would become, the "New York of Canada."

To enumerate a few of the buildings recently erected and in course of construction I may say that in Halifax a new Y. M. C. A. building and a new branch office for the Merchants Bank of Canada have terra cotta fronts, reinforced concrete walls and floor. These are the only buildings in Halifax containing any terra cotta and it is possible that had these been designed by local architects we would still be without a terra cotta example. Ours is a most severe climate and our faith in this material has yet to be established. The Canadian Bank of Commerce recently built a new branch office, using what we call Terrance Bay granite for the fronts, with floors of steel and concrete. This granite is very white and of coarse texture, and makes an imposing facade for buildings of a monumental type. This quarry is some fifteen or twenty miles from Halifax and because of this fact and the weight of the material, the stone figures high in cost. Moir's Limited, manufacturers of bread, etc., have just finished two eight-storey factory buildings and a two-storey stable, all in reinforced concrete as regards floors, whilst one of the factory buildings and the stable have brick curtain walls. The Acadia Sugar Refinery Company are building a large plant across the harbor, using brick walls, steel and concrete floors. In connection with this plant is a chimney 250-ft. high, built of radial brick.

Dalhousie University has undertaken the erection of new buildings, and for their Science building they have adopted the rather strange scheme for the walls of iron stone facing, backed up with granite followed by an air space and an inner brick wall. Cragg Bros., Limited, last year built new premises, using reinforced concrete floors and brick curtain walls, making the only fireproof commercial building in the city. The Dennis office building, finished last summer, has four storeys of Shelburne granite, which is very fine in texture, similar to the Stanstead, and three storeys of brick with steel and concrete floors, making the only fireproof building we have that is devoted entirely to office purposes. The Dominion government during the last five years have erected a new Customs House, built with freestone walls and steel and concrete floors. Besides this they have remodelled the old Post Office, removing the old wooden floors and substituting steel and concrete. Our school buildings, always a matter of interest, have added nothing of importance in the way of development. Whether large or small they continue not to be fireproof, the larger ones being of brick generally, with frame floors. However they have the redeeming feature of plenty of exits. Within the last six years we have built three school buildings with separate entrances, etc., to comply with the requirements of the School Board. These buildings may not be firetraps but certainly they are not fireproof. The local government some two or three years ago built a large Technical College with brick walls, steel and concrete floors. The city council are at present building a large reservoir entirely of reinforced concrete, and also a public market building, the walls of which are reinforced concrete to the spring of the window arches, the balance being of brick. So we might go on enumerating the various buildings of importance. It will be found that apart from wooden buildings brick predominates with wooden floors. Fireproof work is rather scarce and reinforced concrete seems to be obtaining a strong footing.

Drill Boat for Submarine Blasting at Vancouver, B. C.

A pier in Burrard Inlet, Vancouver harbor, is to be built for the Canadian Government, and the contract for this has been let to Henry, McFee & McDonald, of Vancouver, B.C. It includes 150,000 cubic yards of rock excavation to a maximum depth of 51 feet below high water. The present depth of water at the site is from 10 ft. at the shore end to nearly 50 ft. at the outer end, so that the thickness of rock to be removed ranges from a few feet at the outer end to over 40 ft. near the shore end. The maximum depth of drilling will be about 53 feet below high water. The tidal range is about 15 feet.

For this work, the contractors have had built a large drill boat which is said to be the first of its kind on the Pacific Coast. It was designed by A. F. Woolley, consulting engineer, of Vancouver, and the hull was built and equipped at that place under the direction of Mr. Woolley and Mr. Odell, manager for the contracting firm.

The hull is 118 x 30 ft., and 8½ ft. deep, with Oregon pine planking 6 in. thick for the sides, 5 in. for the bottom and 4 in. for the deck. There are four bulkheads of timbers 12 x 6 in. For pulling the boat off and on the range line and getting it into position, there is an anchor and cable at each corner, the cables being handled together or independently by means of a pair of double-drum engines, having two cylinders 6½ x 8½ in. The machinery equipment is mounted in a large deck house, and includes two boilers 5 x 14 ft., a 7500-gal. tank for fuel oil, a 5000-gal. tank for feed water, two oil-feed pumps for the furnaces, two feed-water pumps, and a small steam generator unit for electric lighting. There are also two pressure pumps, one of which supplies the water jets at the drills. The second can be used for the same purpose but is used ordinarily for pumping oil from a barge to the storage tank, and this pump is also connected directly to the pipe lines for fire purposes.

Along one side of the hull are five drill towers, of steel construction, 47 ft. high from the deck. They are mounted on shoes consisting of pieces of inverted 80-lb. rails, the rail heads sliding in channels on timber stringers. The shoes are staggered slightly on alternate towers, so that they will telescope in the channels, thus enabling the towers to be placed close enough to drill holes 5½ ft. c. to c. Heavy setscrews clamp the shoes to the channels while the drill is at work. Each tower has a two-cylinder double-drum hoisting engine which moves the tower by means of a cable which can be hooked to a U-bolt in the deck and led over a sheave to the drum or winch head.

The drills are of the Sullivan submarine pattern, with cylinders 5 x 8½ in. and extension guides for the piston rods. They can drill holes 40 to 50 ft. deep, and on this work the holes will be 3 in. diameter, but the drills can drive holes 2 to 5 in. in diameter. Each drill requires about 18 h.p. for operation. It weighs about 980 lbs., while its mounting weighs about 2,000 lb. The drill is bolted to a heavy casting or recoil block, having a sheave at the top for the hoisting cable, which passes over double sheaves at the top of the tower.

A feature of the mechanism is a cushion valve which prevents the piston from striking either end of the cylinder when working with throttle wide open. This permits the machine to run practically at full speed in starting a hole in broken rock or on a sloping surface, and also aids in restoring a deflected hole to proper alignment. This valve may be used also in pumping out a hole that has become filled with mud before loading. Steam at 120-lb. pressure is supplied to the drill through 1½-in. pipe with telescopic joints.

At each corner of the hull is a 72-ft. timber spud, 30 in. square, with cast-iron shoe. On the top of the spud is a 30-in. sheave, and on its outer face (about 15 ft. above the deck) is a steel grip to which the ends of the two spud cables are attached. Each spud has a two-cylinder double-drum engine. One cable is led under a deck sheave, up the back of the spud to the top sheave and then down the front side to the grip or attachment. The other cable passes from a deck sheave down to a sheave on the side of the spud and then up to the grip. The cables are attached to opposite ends of the drum, so that as one is hauled in the other is paid out. The cables are long enough to bring the spuds to a bottom bearing in 52 feet of water.

Thermal Properties of Concrete

A paper read by Professor Charles L. Norton, to the American Society of Mechanical Engineers, gives a useful summary of the results obtained by a series of experiments carried on at the Massachusetts Institute of Technology during the past four or five years. The main object of the investigation, which is not yet completed, is to collect data bearing upon the physical properties of Portland cement concrete as a fire-resisting material. In the following notes we state the principal results in condensed form for convenient reference.

Coefficient of Linear Expansion.—Table 1 gives the average values for a large number of specimens tested.

TableI.—Coefficient of Linear Expansion of Concrete

Temperature Deg. Fahr.	Coefficient of Expansion Per unit of length per deg. Fahr.
72 to 250	0.0000045 to 0.0000060
72 to 750	0.0000050 to 0.0000060
72 to 1,090	0.0000045 to 0.0000050
72 to 1,600	0.0000035 to 0.0000042

The value at low temperatures agree fairly with the generally-accepted value of 0.0000055 for the unit elongation per deg. Fahr. A considerable number of tests demonstrated the fact that the expansion depended more upon the temperature of the outer surface than upon the average temperature of the specimens. Therefore Professor Norton concludes that in reinforced concrete at high temperatures, as in case of fire, the divergence of the coefficients for concrete and steel is not a serious matter, since the metal reinforcement and the concrete surface are not at the same temperature.

Diminution of Strength after Heating.—Tests conducted on small cubes showed that the losses of strength due to exposure for two hours to temperatures of 900 deg. and 1,700 deg. Fahr. were 15 per cent. and from 50 to 65 per cent. respectively. It should be noted, however, that owing to the small dimensions of the cubes and to the fact that they were entirely surrounded by flames, the results are not applicable to concrete as employed in actual construction. Some tests were also carried out on small beams, but, as Professor Norton remarks, they were not very helpful in giving information concerning the behaviour of full-sized beams in buildings, and except as giving information concerning different mixtures of concrete the results are of very little value.

Specific Heat.—Table 2 gives the specific heat for three mixtures of concrete, as determined by Professor Norton. As the specific heat of a body denotes the number of thermal units necessary to raise the temperature of 1 lb. of the body 1 deg. Fahr., this factor is of importance in connection with the warming of buildings as well as with their resistance to fire.

Table 2.—Specific Heat of Concrete

Temperature	Stone Concrete		Cinder Concrete
	1:2:5	1:2:4	1:2:4
Deg. Fahr.			
72 to 212	0.156	0.154	——
72 to 372	0.192	0.190	0.180
72 to 1,172	0.201	0.210	0.206
72 to 1,472	0.219	0.214	0.218

Heat Conductivity.—Apart from its importance in all questions connected with the protection of steelwork and steel employed as reinforcement, the thermal conductivity of concrete directly affects problems in warming practice and the comfort of buildings in which concrete is employed as a structural material. Table 3 gives results ascertained by Professor Norton.

Table 3.—Heat Conductivity of Concrete

Temperature of Heated Surface	Composition of Concrete		British Thermal Units per deg. Fahr. per sq. ft. per. in. thick per 24 hours
Deg. Fahr.	Aggregate	Proportions	
95	Stone	1:2:5	150
122	Stone	1:2:4*	76 to 144
122	Cinder	1:2:4	56
392	Stone	1:2:4	146
752	Stone	1:2:4	153
932	Stone	1:2:4	160
1,832	Stone	1:2:4	188
2,012	Stone	1:2:4	202

A wire rope incline 6,000 ft. long, with two curves, is used to lower stone down Table Rock Mountain, near Boise, Idaho. The mountain rises 900 ft. above the river at its base, and on the summit is a ledge of sandstone said to be of fine quality for building purposes. Quarries have existed on this ledge for many years, and it was the difficulty in getting this stone down the mountain that led the Boise Stone Company some years ago to build the incline. Except at the bottom, where the line branches out into two two-rail tracks to allow cars to pass, the incline is a single three-rail track, which is virtually a double track, one car running on the first and second rails and the other on the second and third—each car controlled by a single cable on rollers between its corresponding rails. Leschen plow-steel cables 1⅜-in. in diameter are used.

Mr. Cozzolino, President of the Nova Scotia Construction Company, contractors for the government pier in course of construction at the north end of Halifax harbor, stated at Montreal a few days ago that the firm had sunk 160,000 concrete piles from 56 to 78 feet in length, each weighing as much as 25 tons, and driven into the bottom of the harbor (where the water reaches a depth of 38 to 40 feet) by a hammer weighing about sixteen tons. This he regards as the solution of the concrete pier problem, a matter which has been discussed by engineers and contractors for a long time. Although the work is well advanced there are 300 piles still to be driven, making a total of approximately 200,000. The cost of the work, which will be completed about August, will be in the neighborhood of $1,000,000.

Features of The Northern Electric Company's New Plant at Point St. Charles, Que.

THE position of importance as an industrial center occupied by Point St. Charles, that portion of the city of Montreal lying southward from the Lachine Canal toward the Grand Trunk Shops and the St. Lawrence River, is receiving no mean impetus from the erection of the large group of buildings now under construction for the Northern Electric Company, Limited, formerly The Imperial Wire & Cable Company, Limited, and the Northern Electric & Manufacturing Company, Limited. These buildings will, when completed, constitute what is undoubtedly one of the largest single industrial units ever built at one time in the Dominion of Canada. There are probably larger plants operating to-day, but these have been built up gradually by additions to the original buildings.

The ground covered takes in almost the entire block bounded by St. Patrick Street, Shearer, Richardson and Richmond Streets, a total area of over 178,000 sq. ft., and the floor space in the completed buildings will total over twelve acres in extent. An idea of the size of the work can be obtained from the fact that the weight of structural steel used will be approximately seven thousand tons, while the order placed with the National Fireproofing Company of Canada for tile is said to be the largest single order ever given for any industrial work in Canada other than for elevator construction.

Approaching the main entrance on Shearer Street, the two main buildings will, when completed, present a frontage of some 320 ft. in length on both Shearer and Richardson Streets, rising to a height of eight storeys above first floor level. (Figs. 1 and 1a.) A massive granite base is carried around all street frontages at a uniform level, on Richardson Street rising to a height of about 12 ft. above the sidewalk. Above this the front is of La Prairie plastic brick, laid in purple mortar with widely raked joints and trimmed with architectural terra cotta lintels, belt courses and medallions of a color to match the brick. The whole will form one of the most effective fronts presented by any manufacturing plant in Canada; the effect of the wide joint and purple mortar being to set out the brickwork and make a very striking wall.

The two main buildings have a width throughout of 60 ft. and in these alone there will be nearly 275,000 sq. ft. of available floor space. Parallel to building "B" on Shearer Street and running back from building "A" are two wings 60 ft. in width and over 300 ft. long, at present being finished to a height of four storeys only, although the foundations are designed for a future extension to the same height as the main buildings.

A layout of the property and buildings is shown in Fig. 2. The two main buildings are marked Section "A" facing on Richardson Street, and Section "B" facing on Shearer Street, while the two wings will be known as Sections "E" and "G." Light courts are provided between wings, the spaces being taken up with one storey buildings, known as Sections "D" and "F." These two buildings will have trussed roofs with I-beam purlins supporting T irons and book tile, overlaid with ready roofing. The roofs of the main buildings will also be supported on trusses and book tile carried on T irons covered with Barrett specification roofing. The future fifth floor permanent tile arches of buildings "E" and "G" will form the present roofs of these two buildings, slopes being formed with cinder concrete and covered with Barrett specification roofing.

The other buildings, shown on the block plan, Sections "H," "M," "N," "O" and "P," are of one storey, with book tile roofs covered with roofing of same specification. Sections "Q" and "R" are respectively the boiler room and turbine room.

As in all modern industrial works, particular attention has been paid to lighting and ventilating facilities, all roofs being provided with as large a measure of skylight space as possible, and sash generously provided with ventilating sec-

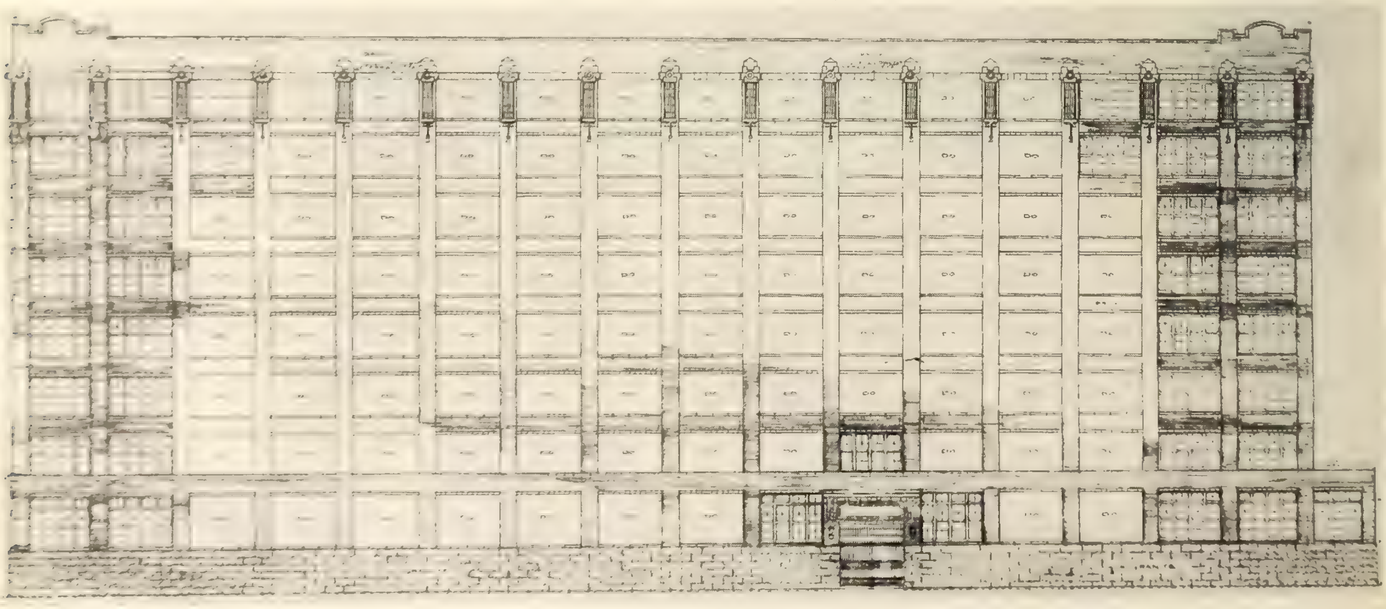


Fig. 1.—Richardson Street elevation, Northern Electric Company's plant.

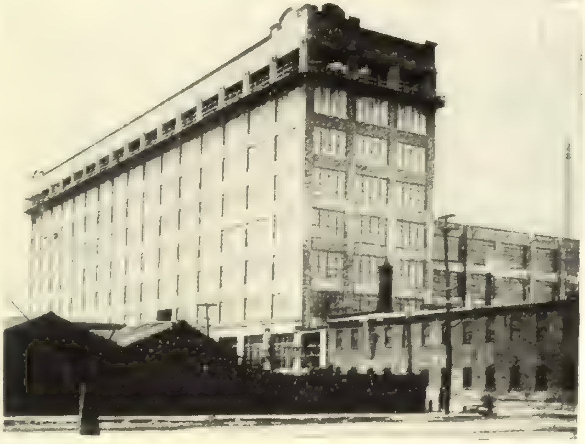
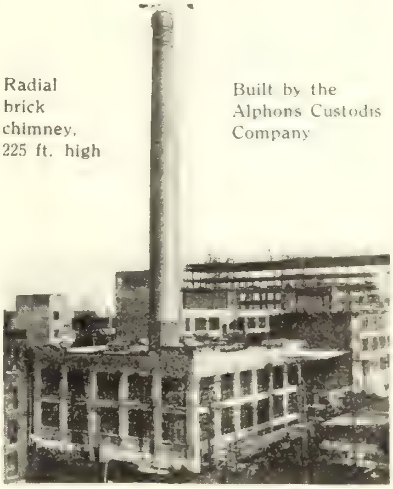


Fig. 1A.—Photographic glimpse of the Northern Electric Company's plant now nearing completion.



Radial brick chimney, 225 ft. high

Built by the Alphons Custodis Company

Fig. 3.—Power house and chimney.

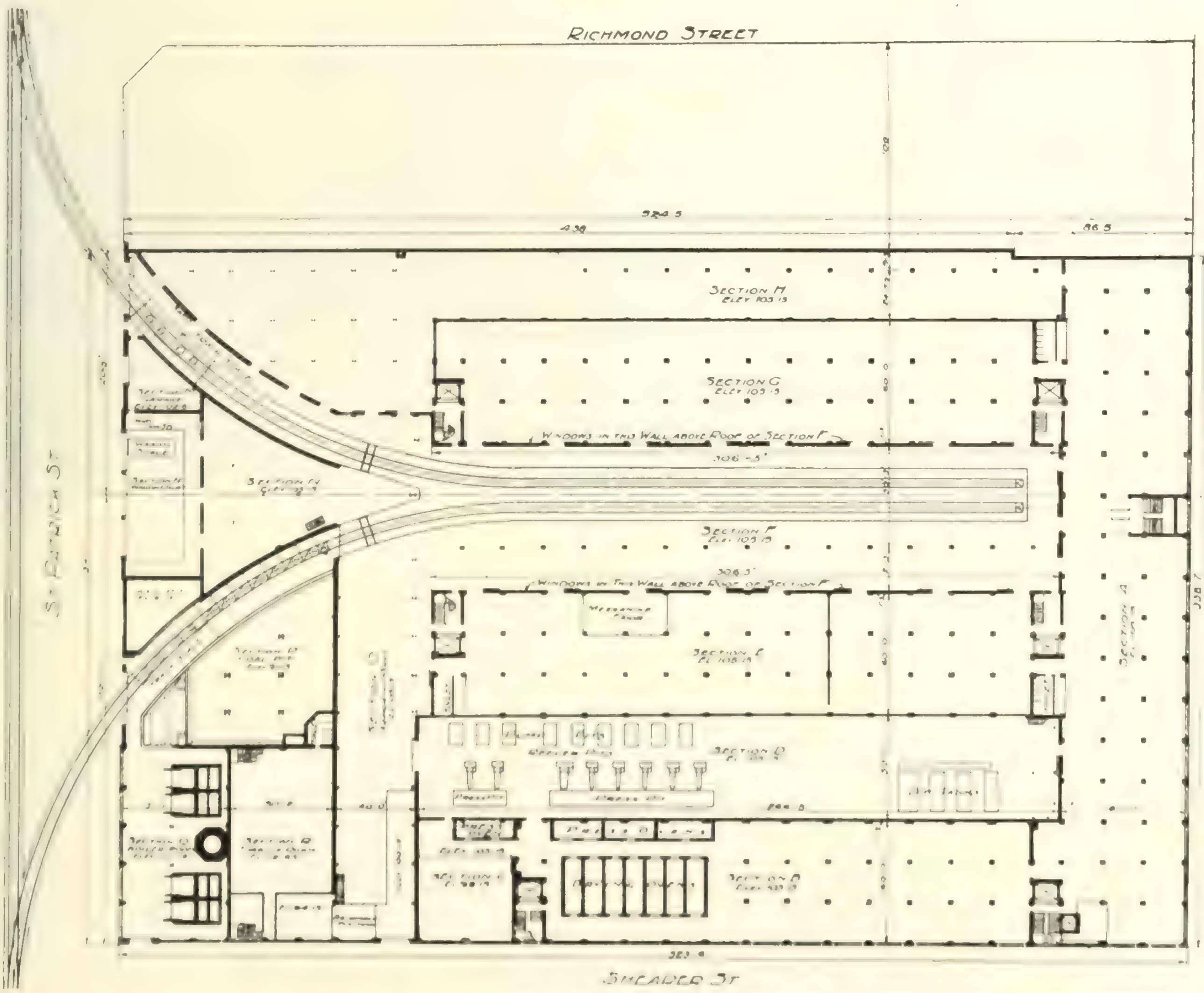


Fig. 2.—General plan of the property and buildings.

New Plant of The Northern Electric Company, Limited

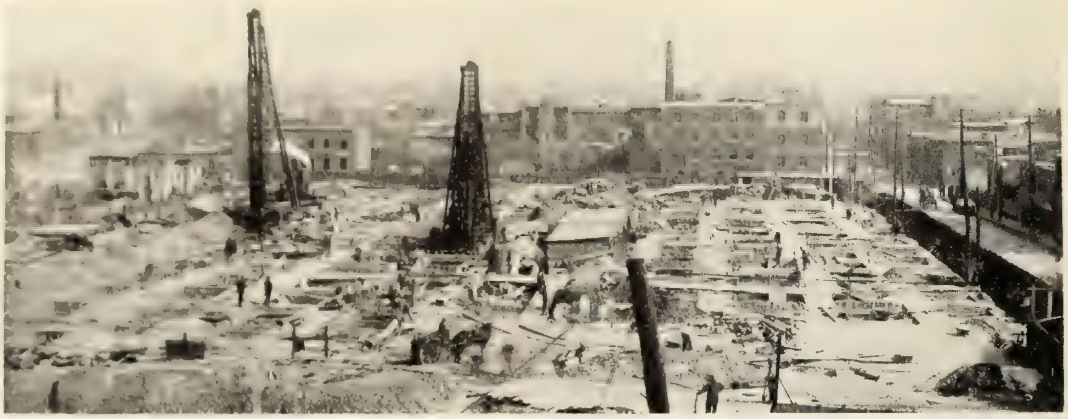


Fig. 4.—View of operations on the Northern Electric Company's plant during the progress of foundation work.

tions. Monitor skylights, with pivotted sash in the sides, are used on all roofs except those of sections "D" and "F" where flat skylights are installed. Trussed Concrete Steel Company's sash is used and occupies a large percentage of wall areas.

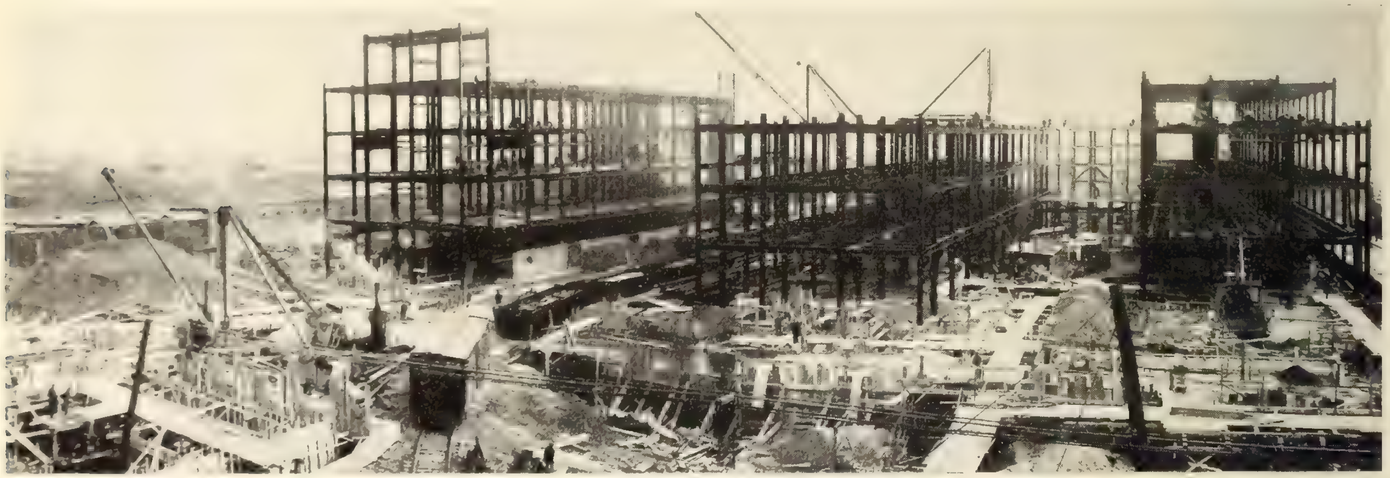


Fig. 5.—General view showing steel work of the Northern Electric Company's plant partly completed.

Shipping and receiving facilities are provided by sidings connecting both the C. P. R. and G. T. R. These tracks run the entire length of section "F" which will be used as a shipping department. Where the C. P. R. track passes through section "P" it is carried over a steel trestle with a sloping bottom, so that coal for the power plant can readily be unloaded and handled by conveying machinery, either directly to the boilers or to be stored in section "P."

The power house is designed to supply all power and heating required in the various buildings. Babcox and Wilcox boilers will be used and all generators, pumps and accessory machinery will be steam turbine driven. Exhaust steam will be used for heating the buildings, this being a forced hot water system. The chimney is one of the largest in Montreal, rising to a height of 225 ft., with a 10-ft. diameter flue and having

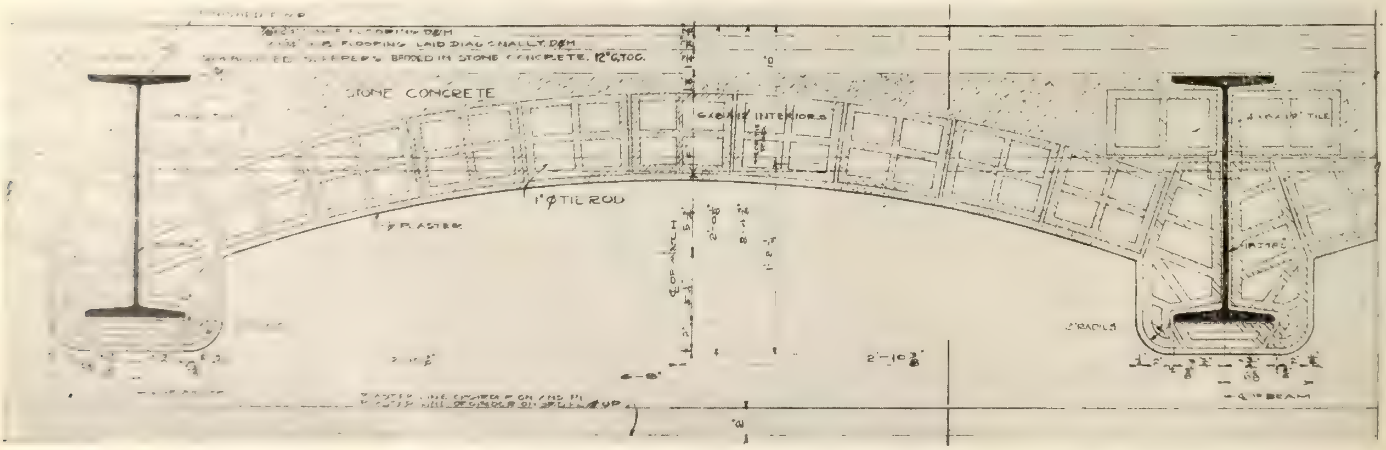

FLOORING LAID DIAGONALLY D&M
BEDDED IN STONE CONCRETE. 12" C. TO C.
STONE CONCRETE
1" ϕ TIE ROD
PLASTER
2'-10 3/8"

Fig. 6 (Northern Electric Company's plant).—Section through typical interior floor panel.

an exterior diameter at the base of 18 ft., decreasing to 11 ft. at the top. This is of radial brick, constructed by the Alphons Custodis Chimney Construction Company. Fig. 3 shows the Power House and chimney, from which an idea can be formed of the finished appearance of the various buildings. The construction is fireproof throughout, consisting of structural steel skeleton with fireproofed columns, beams and girders, brick curtain walls, metal sash glazed with wired glass; and steel and tile roofs.

The foundations of the larger buildings are laid on groups of piles driven by the Raymond Concrete Pile Company, the design calling for from three to twenty piles in each pier. About four thousand piles averaging some sixteen feet, in length were driven. Fig. 4 shows a view of the property at this part of the construction, and it will be noted that all excavation work for pier footings was carried on in caissons and the piles driven from the surface of the ground. The steel work throughout is of Bethlehem sections. It was fabricated and erected by the Dominion Bridge Company. Fig. 5 is a general view showing the steel work of Sections "B," "E" and "G" partially completed. This steel work is thoroughly fireproofed throughout by structural tile supplied by the National Fireproofing Company. The columns are covered with a 4-in. thickness formed of two 2-in. layers carried on top of sheet metal casings filled with concrete, some five and a half feet above the floor. The floor construction consists of a 6-in. segmental tile arch, this being the first example of such construction used in Canada. Figs. 6 and 7 show a typical section of this arch and the way in which beams and girders are fireproofed and floor sleepers embedded in concrete spandrel filling. On top of this is an underflooring of one-inch Canadian white pine and a top floor of clear maple.

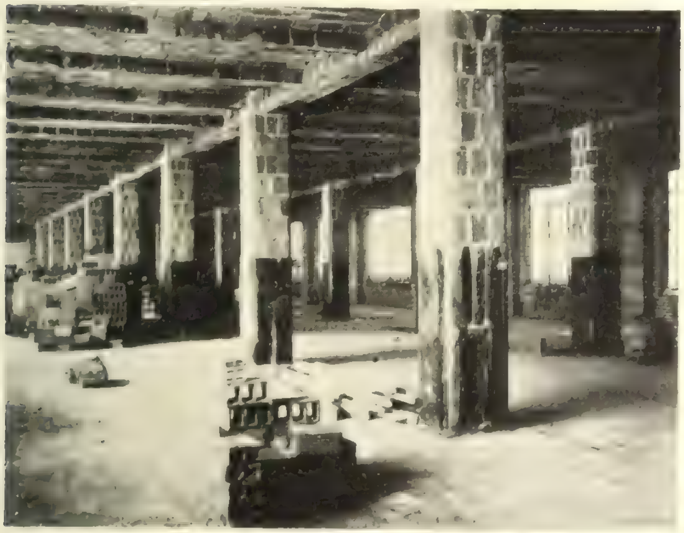


Fig. 7.—Illustrating method of fireproofing beams and girders and embedding floor sleepers in concrete spandrel filling.

Considered as a whole the buildings form an excellent sample of modern industrial building design, embodying the important principles of compactness, full measure of light, adequate working space, fire-proof efficiency, and the use of first class workmanship and materials throughout.

About 50,000 cu. yds. of material has been excavated, about half of this quantity being used for backfilling and grading. Over 14,000 cu. yds. of concrete have been used in foundations exclusive of piles. The quantity of brick required for the whole job will approximate 6,000,000. Over 9,000 tons of structural tile has been used in fireproofing floors and roofing. Approximately 100,000 sq. ft. of glass is required for glazing the metal sash, exclusive of glass required for skylight work.

The work has been carried on under the direct supervision of Mr. E. F. Sise, President of the Northern Electric Company; Mr. J. D. Hathaway, General Superintendent; and Mr. W. J. Carmichael, Architect. The general contract has been carried out by Messrs. E. G. M. Cape & Company, Limited.

Reinforced Concrete Water Tanks in India

Two reinforced-concrete waterworks tanks, each of them 66 feet in diameter and 20 feet deep, have been built at Gaya in India. The thickness of the reservoir walls varies from 1 ft. 8 in. at the bottom to 9 in. at the top. The reinforcement consists of ¾-in. diameter round bars spaced two inches apart at the bottom and 9 in. at the top. The concreting of the walls was started about the end of February, 1912, just at the beginning of the extremely hot weather. Gaya is one of the hottest places in Eastern India, and the maximum temperature on the hill where the reservoirs stand, surrounded by bare rocks which reflect the heat with great intensity, probably reaches nearly 160 deg. in the sun during the hottest weather. Moreover, a dry west wind usually blows strongly in the daytime from the end of March onward. Notwithstanding these difficult climatic conditions, the reservoirs were constructed successfully. The inside was after completion plastered with 1:1 cement plaster ¾ in. thick, and the outside with cement plaster made up of three sand to one cement ½ in. thick. After the reservoirs were filled some moisture appeared on the outer face but apparently from general porosity rather than from any well defined leak. Most of these porous places have since become closed and the reservoirs are now practically watertight. An interesting feature of the work was the method by which the concrete was transported after mixing to its place in the walls. A large number of female coolies were engaged who carried the mixed concrete in small buckets on their heads. A bamboo staircase was built inside the reservoir wide enough for a stream of coolies coming in one direction to pass the stream returning.

Driving piles below grade has been necessary in the reconstruction of the 1,000-ft. Matawan Creek double-track trestle on the New York & Long Branch Railroad in New Jersey. The pile foundations were driven between the old bents about 12½ ft. apart and 30 ft. high while traffic was maintained on one track. The piles were 45 to 70 ft. and part of them were driven by a locomotive crane equipped with swinging leads having a telescopic section allowing the No. 2 Union steam hammer to follow the pile down 30 ft. below track grade. Part of them were driven with an ordinary driver with a 30-ft. follower. The pile bents were cut off, sills laid on them, caps secured under the existing stringers and the ten trestle posts inserted separately in position between them because clearance was not available for framing the trestle bents before erection. The work involved about 1,100 piles and 750,000 ft. of long yellow-pine trestle timber.

A report on the clay and shale deposits of New Brunswick, covering work done in that province during 1911-12 by Mr. Joseph K[illegible] just been issued.

The Artistic Possibilities of Bonds and Mortars in Brickwork*

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Part II.—(Conclusion)

ONE of the most essential elements in brickwork is the mortar in which the bricks are laid. Upon examination of the definition of bond given above, we can see how it might be possible under the most favorable conditions to erect a wall without the use of mortar. In fact, the Greeks in their masonry construction did so erect their marble walls by rubbing the blocks together, after applying sand and water to the joint, until the desired planes were obtained. Thus laid the large blocks of marble, which were of sufficient size and stability to retain their positions in the wall by gravity, made a perfect wall. With our small clay unit of brick, however, there is not sufficient weight to a unit to permit the Greek procedure. Hence mortar is used, and it fulfils the double function of providing for each individual brick a bed in which the irregularities of surface are overcome and, what is still more important, of surrounding each brick with a bonding material which eventually produces a monolithic structure.

Mortar discharges two functions—the one structural, having to do with the nature and composition of the mortar as a bonding material; the other ornamental, affecting the appearance of the joint on the face of the wall, produced by its form, color, and texture.

Structural Uses of Mortar

Viewing the matter from a structural standpoint, it is of fundamental importance to use a thoroughly sound, well tempered, and well mixed mortar, neither too stiff nor too plastic. The proportions of the ingredients should be kept strictly uniform throughout any given job. The building ordinances of every large city dictate the legal composition of mortar to be used in that city.

Generally speaking, mortar is composed of cement and sand, or lime and sand, or cement mortar and lime mortar, mixed in various proportions. But to secure certain desired results, the sand may be partly or entirely replaced by other materials. Thus for a wide joint fine gravel—not over one-fourth inch in diameter—ground granite, or crushed birck is used wholly or in part for the sand. For a white joint, coarsely ground white marble or limestone may be substituted; or for fine joints, which are meant to be very white, pulverized white marble is frequently used.

In any case the material must be of the very best. The cement should pass the proper and usual tests as set forth by the American Society for Testing Materials; the lime should always be fresh and well burned, and of a character which will slake into a smooth and even consistency, without lumps of hard or underburned material; and the sand should be free from loam, pieces of charcoal, iron oxide, or other material of like character.

A great many architects will not permit the use of anything but a purely cement mortar. A number of city ordinances also require that the mortar used shall not be inferior to a mortar composed of one part of Portland cement and three parts of clean sand, thoroughly mixed dry, so as to be of one uniform color, with the proper amount of water added to make a smooth working composition; and shall be used while fresh. Some engineering authorities, however, will permit of as large a proportion as four of sand to one of cement.

The usual practice is a mixture of lime mortar and cement mortar. A specification for this mortar would be as follows—or in similar proportions: "The lime mortar shall be composed of five bushels of fresh burned lime to one cubic yard of sharp river sand; this mortar to be made up so as to have two weeks' supply ahead of the work—no lime mortar that is not at least two weeks old to be ued. The cement mortar is to be composed of one part of approved Portland cement (showing a tensile strength of 500 pounds per square inch on seven days' exposure) and three parts of clean sand; the cement mortar to be mixed fresh each day just before being used and in such quantities that none shall be left over at the end of the day's work. Take of the above mortars equal parts, thoroughly mix and use fresh, not allowing the mortar to set before using in the walls," Thus mixed, these mortars when set become a pale gray color, of either a greenish or bluish tint, depending upon the brand of cement used. The effect of lime mortar in the mixture is to produce a much lighter color in the finished joint than is obtained by the use of a pure cement mortar.

Artistic Effects

But being primarily interested in the artistic aspects of brickwork, it is fitting that the form, texture, and color of the joint as it appears on the face of the wall should here be emphasized. The form and color of the mortar joint become an added factor in the development of artistic brickwork and should be used with understanding and skill, since as usually estimated, the surface of the mortar ranges from one-seventh to one-fourth of the whole surface of the completed wall. The entire color scheme of the wall may be changed either by the manner of treating the mortar joint or by the introduction of color into the mortar Thus the flush joint, that is, the cutting of the mortar flush with the face of the brick, results in a decided line of color, which may be large or small according to the size or width of the joint. Or, to take another example, with the sunk or cut joint, which practically eliminates the color of the mortar altogether, we get a shadow line around each brick.

The study of color in the mortar joint will often enable the designer to bring his entire wall surface into the harmony of color he is striving for. On the other hand, piers and openings may be featured, and architraves and quoins may be produced around an opening or at the angles of the building, by the simple expedient of using a flush joint at these places and a sunk joint on the intermediate surfaces, or the reverse.

Bond pattern in brickwork may be entirely lost by the use of a mortar joint ill-chosen in form or size; while beautiful texture and beautiful pattern may be accentuated through the mere treatment of the joint alone. Or pattern may be brought out in a brick wall of uniform color by the way in which the border joints, enclosing the pattern units, are handled.

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*By the kind co-operation of The Hydraulic-Press Brick Company, St. Louis, Mo.

Texture in the joint, that is, the surface of the mortar as it appears to the eye, should harmonize with the texture of the brick. Thus a rough-textured brick is shown to the best advantage by a rough joint. A rough joint however, it must be observed, does not mean an unworkmanlike joint. All joints, rough or smooth, should be workmanlike in that they meet the edges of the brick in a clean, sharp manner.

A rough or granulated surface in the joint is obtained by the use of very coarse sand or fine gravel, the face of the joint being either cut with the trowel or scraped with a jointing stick so as to roughen the surface of the mortar. A smooth joint is obtained by the use of a steel jointing tool, or by pressure applied to the toe of the pointing trowel. Large joints should usually be rough surface joints, and, as already indicated, are used to best advantage with rough-textured brick, although beautiful effects may be obtained by using this joint with a smoother or fine-textured brick. Some of the most famous brick designs in this country, however, are of the opinion that all rough-textured brick should have a raked joint, that is, a joint cut back from the face of the brick, often very deeply, "leaving the brick surface thus free to expose its color and texture, and the individual brick to play its part and place as a unit therein."

Kinds of Mortar Joints

The usual mortar joints in good brickwork are indicated in the accompanying cross-section sketches and photographic reproductions. Joints A and B are trowel-struck joints, and are usually made by the bricklayer as the work progresses, being the common jointing in ordinary brickwork. As American mechanics usually work from the inside of the wall, joint A is the easier joint to strike, while joint B, the so-called weathered joint, requires more care, as the trowel has to be worked from below. But this form of joint is the better able to shed the water and is the more permanent joint of the two.

Joint C is a raked joint, made by removing the surface of the mortar, while it is still soft, with a convenient tool. Joint D shows a set-back, or stripped, joint which is made by laying wooden strips on the top of each course and filling up with mortar behind these strips, bedding the brick on the top of the strip which is removed when the mortar is sufficiently hard to sustain the weight of the brick. While the joint stripping adds considerably to the expense, it accomplishes the result of having the bottom edge of the brick on a level line, prevents the smearing of the face with mortar during the course of erection, and generally tends to equalize the hoizontal joint. Both the raked and the setback joint have a tendency to darken the appearance of the wall, owing to the deep shadow which the joint makes on the surface. These joints are very effective and bring out with great distinctness any pattern with which they may be used.

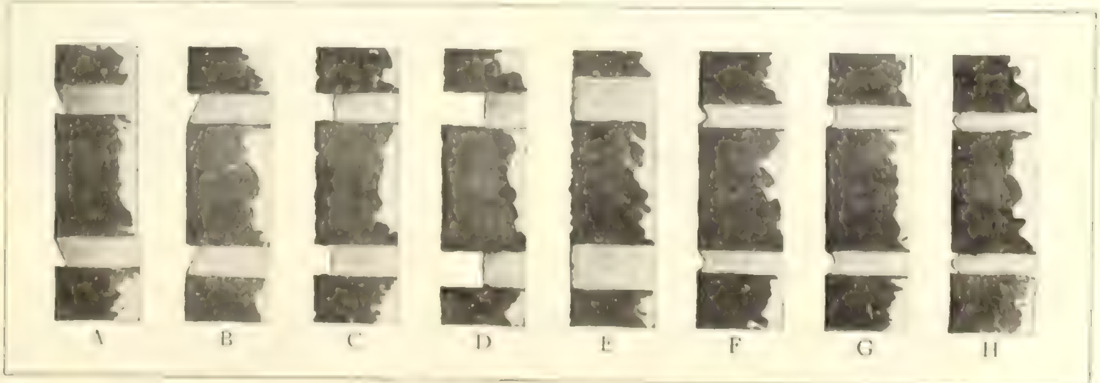
Joint E is a rough-cut flush joint, which is made by cutting off with the trowel the surface mortar projecting beyond the face of the brick. The exposed surface of the mortar must be left just as it is after the excess mortar is cut off, as any repointing or patching of the joint is not only very apparent and breaks the color effect of the surface of the joint, but also is likely to be injured by the action of the elements.

Joints F, G, and H practically belong to the group of pressed brick and smooth surfaces, and are joints that are normally kept quite small. They are better suited to interior work and are formed by the use of a steel jointer which, in order to make the lines true, is drawn along a straight edge.

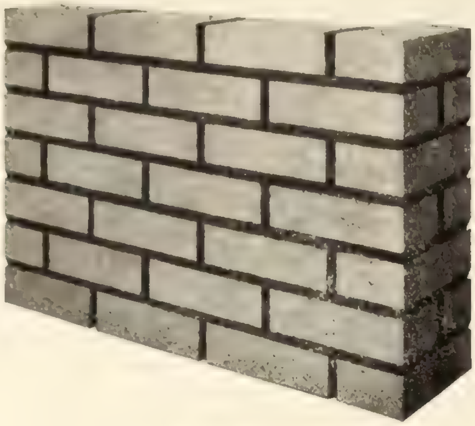
Terrace floors and steps, when built of brick, are usually pointed with what is called a "thumb" joint, which is a broad slightly concave joint thoroughly rubbed down with a steel jointing tool. It is good practice to have the exposed face of brick used for terrace floors and steps given a good coat of raw linseed oil immediately before laying, as this practice prevents the mortar from sticking to the face of the brick and permits of clean, clear, finished work.

The addition of color to mortar is one of the expedients that is at the command of the designer of artistic brickwork, to produce that nice degree of harmony of the total wall surface so frequently necessary for securing the essential character of his design. Colored mortar is needed to bring out the life and character of certain tones of brick and is in itself a serious study. The color required to harmonize with certain brick tones can only be found by experiment, and that experiment should always consist of laying a section of sample wall in the colored mortar joint as proposed, large enough to permit a judgment on the finished whole.

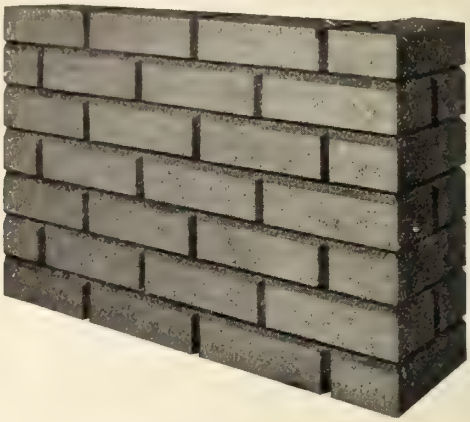
There are many fine artistic effects that may be secured by the use of artificially colored mortar which harmonizes with color tones and textures in the brick. Two walls laid of absolutely the same kind of brick will present an altogether different appearance if laid



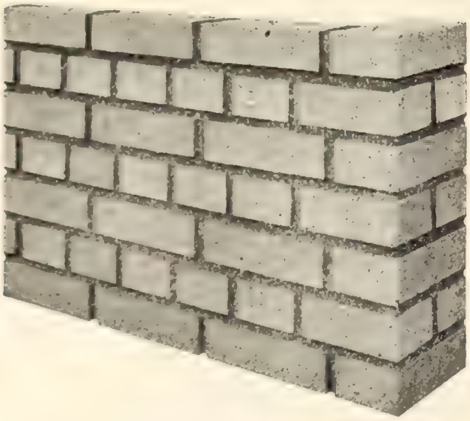
Bonds and Mortars in Brickwork



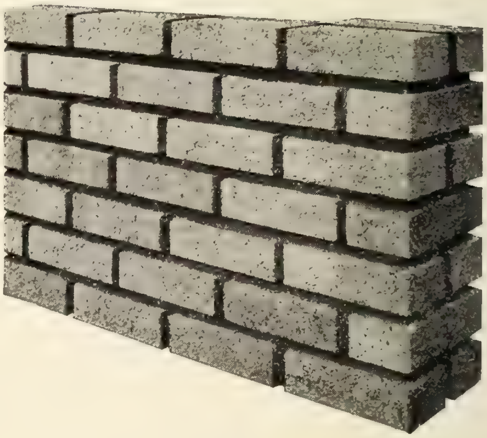
Struck Joint



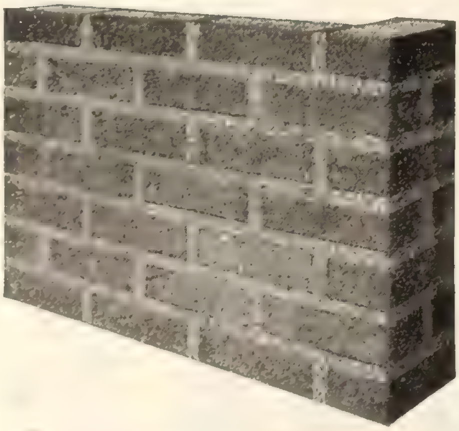
Weathered Joint



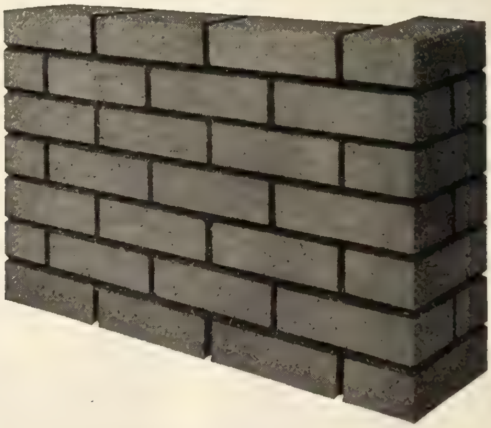
Raked Joint



Set-Back, or Stripped, Joint

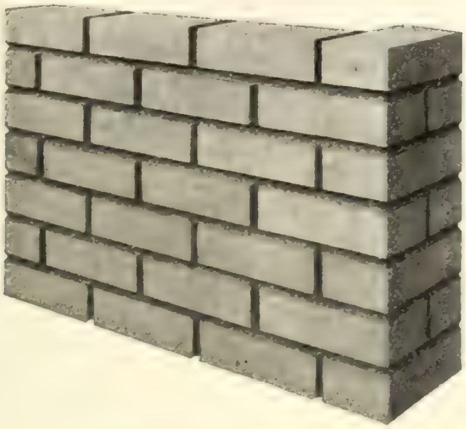


Rough-Cut Flush Joint

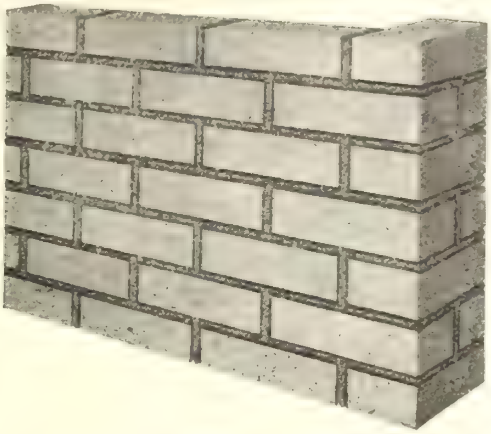


V-Shaped Joint

The Artistic Possibilities of Bonds and Mortars in Brickwork



Round, or Rodded, Joint



Beaded Joint

Bonds and Mortars in Brickwork

in different colored mortars, an effect that is enhanced if, in addition, there are used different forms of joint. In one wall use a rough-cut flush joint of dark mortar, and in the other a light mortar raked out deep, and the observer could hardly be persuaded that the same brick had been used in both walls. But mortar colors, the reader must be advised, are materials rather difficult to deal with, and the greatest care must be taken in their selection, not only to secure just the shade wanted but to avoid using those that are chemically affected by the lime or cement of the mortar. An otherwise beautiful wall may be almost ruined by a false tone of color (artificial or natural) in the joint, while, on the other hand, its beauty may be greatly refined and enhanced by the employment of a harmonious color in the mortar.

There are two methods by which colored mortar may be used. The first is its use as the actual working mortar in which the wall is laid. The second is its use in tuck-pointing the wall at the completion of the job. In rough-textured joints the first method is practically necessary. Where a steel jointer may be used, tuck-pointing becomes much the best method of producing the desired result. Fortunately for the designer, it is seldom necessary to produce vivid or strong color in a rough-textured joint.

The ideal practice would be first to complete the entire wall with an inch-deep raked joint, and then, after cleaning down the work, to tuck-point it in fair weather from one batch of the properly colored mortar, at one time, and in one operation. Some colors more than others, especially blacks, seem to require this care, for the daily stoppages of the work and other delays show in the bleaching of the last few joints on the top of the unfinished wall, caused by the action of the sun and the elements. But as, in view of the added expense, this is rarely done, the next best expedient is to cover the last few courses at the end of each day's work, and to secure an experienced and conscientious mixer who has the ability and inclination to use exact proportions in reproducing from day to day the uniform batches of colored mortar necessary to complete the work.

The two-and-a-half-million-dollar plant now in course of erection at Dauntless, Alta., for the Canada Cement Company, is being equipped with five kilns, each 24 ft. in length and 10 ft. in diameter, each of the 85-ft. sections weighing 720 tons, including the brick lining and an average load of material. These are said to be the largest cement kilns in Canada and the second largest in the world. A ten-ton gear is equired to drive each kiln and bearings weighing 15 tons support the weight. The raw material passes into the kilns in a semi-fluid state, the moisture being driven off by hot gases at a temperature of 2,500 deg. Fahr. The cost, including installation, will be $75,000 for each kiln. The plant at Dauntless when completed will have a daily capacity of 4,000 barrels.

A new industry has been started at Lethbridge, Alta., under the title of the Lethbridge Face Brick & Clay Products Company. Mr. Jas. M. Close, of Woodstock, Ont., who is the inventor of several important machines used in brick manufacture, has arrived in Lethbridge and will devote his whole time to the management of the new business. The company, which includes Mr. William Close and Mr. Charles Cherrett, also of Woodstock, intends manufacturing tapestry brick, dry pressed brick, hollow brick and drain tiles, and it is anticipated that the first products will be on the market early in July. A site of sixteen acres has been purchased from the C. P. R. for the accommodation of the plant.

Brick and asphalt block pavements at Savannah, Ga., are laid on a carefully prepared natural earth foundation. According to Mr. E. R. Conant, Chief Engineer of the city of Savannah, this soil is, with few exceptions, well drained sand mixed with loam or clay, and, when thoroughly rolled or tamped, gives such good results as a foundation as not to warrant the use of a concrete base where the traffic is light or medium. The pavement subgrade is shaped roughly, finished with a steel-lined wood-drag and tempered with water. The brick or asphalt blocks are laid directly on the subgrade, and the points are filled with sand. Brick have been laid on edge heretofore, but laying flatwise is under consideration. Unevenness in brick pavements in Savannah, Mr. Conant states, is due not to a yielding of the foundation, but to the wear of the brick. Last year some of the old brick pavements were taken up and turned and relaid, and about 10 per cent. of the total replaced with new brick, all at a cost of about 30c per square yard. The average cost of brick pavements for ten years past at Savannah, laid as above, has been $1.55 per square yard.

A Discussion of Coal-Tar and Asphalt Products for Waterproofing*

By S. T. Wagner

THE increasing number of solid-floor bridges, especially in cities, involving waterproofing and the expenditure of large sums of money, and the necessity of thoroughly protecting steel reinforcement in concrete under certain conditions, as well as the waterproofing of masonry in general, make the study of the various external methods of waterproofing of the greatest importance. The methods referred to consist in the application to the surface to be waterproofed of either a membrane of felt or fabric of some kind thoroughly cemented together with some bituminous material, or a layer of inorganic material impregnated with the same substance. There can be no question but that the bituminous material so used is the real waterproofing medium, and that all other materials incorporated therein are simply fillers to retail the bituminous material in place and give it additional reinforcement of some kind. Whether the waterproofing is applied for the protection of the public from drippings from an overhead railway bridge, or is used to prevent the corrosion of reinforcing material in concrete construction exposed to water, the object in either case is to obtain a layer of durable waterproofing material which is suitable to each particular case. Waterproofing is expensive, it is always very difficult and costly to repair if defective, and it behoves the engineer to use the best materials that he can secure and to apply them with the greatest care to the structure, which should be especially designed to meet the necessary details required in good waterproofing practice. There is much uncertainty at the present time as to a number of points in connection with this character of work, but there appears to be almost complete agreement that the perfect or imperfect application of the materials determines a good or bad piece of work. It would appear that, outside of particular instances where waterproofing is used to keep water in, the majority of cases are those in which the object is to keep the water out, and of these a very considerable portion of the structures requiring its use are essentially different, as indicated above—first, solid-floor bridges; second, underground masonry. In the first case the conditions are such as to require special elasticity at all temperatures, in order that the waterproofing may adjust itself to the vibrations of the structure, especially in the cases of railroad bridges of relatively short span. It is usual to have a regularly ballasted floor, which, if properly drained, makes a condition for which we can say in general that the oxidising action of the air is probably a more potent factor in the disintegration of the waterproofing material than the action of whatever water may be present. In the second case, we may safely say that when the masonry is covered with even a small amount of earth, the action of the air is negligible and that of the dampness, or water, is the more serious. In some instances water may be in constant contact with the waterproofing. The materials to be used should, therefore, have chemical and physical characteristics which make them suitable for the above-mentioned conditions.

There are in use at the present time two general classes of materials for waterproofing purposes when the conditions are as just described: First, compounds of an asphaltic nature; second, coal tar pitch. Both of these materials have been, and are at present, used quite extensively and with varying success. The successes or failures in many cases have been due to proper or improper application as much as to the inherent qualities of the materials themselves, and it is believed that the successful use of either class has often been attributed to this fact rather than to the real qualities of the materials, and that at the present time the amount of reliable data as to what is needed in the way of a specification for the proper material to be used is woefully lacking. To one who is not a modern chemist and thoroughly versed in the mystic symbols of the hydro-carbons, the chemistry of these materials is almost hopeless in its practical application; but it is quite evident that there is an essential difference between them chemically—that is, between such figures as are usually given in chemical analyses. The physical properties are apparently much more interesting and useful to the practical engineer, and it would seem that we could do away with the chemical data unless they indicate properties which, when translated, will enable us to distinguish undesirable, or it may be, dangerous, elements. We can understand and appreciate such figures as melting point, brittle point, elasticity at various temperatures, and consistency, and data concerning these properties give us a very fair idea of the various physical properties.

The data which seem to be needed are those from laboratory tests which will enable as to determine the relative durability of these products—first, when exposed to the air; second, when exposed to water; and third, when alternately wet and dry. Any such test is, or would be, essentially an accelerated test. It is possible that at the present time the question of durability might have to be answered by practical experience with the different materials in existing structures. However, it does seem that some information as to what we should aim at and what should be avoided is due from the manufacturer or the chemist. Nothing inspires the confidence of the user of a structural material so much as the free discussion of the methods of manufacture on the part of the manufacturers. Experience in the past with other materials has shown that this confidence is not abused in the preparation of specifications. Such information is badly needed in connection with waterproofing materials. From recent investigations and research there seems to be a general impression that when exposed to the air, asphalt products are more durable than coal tar products, and that the opposite is true when exposed to water. The opinion that asphalt products are more suitable for use on solid-floor bridges seems to be of general, though not universal, prevalence, on account of the greater elasticity of this material at low temperatures. In other words, an asphalt product with a melting point of 150 deg. Fahr., which will be ductile at a temperature of 40 deg. Fahr., or lower, can be obtained, while a coal-tar pitch with the same properties can not. It has been the experience of the writer that asphalt mastics made with natural rock asphalts, when fluxed with asphalt compounds of high ductility at low temperatures, produces mastics which are much less liable to crack in service than are those in which the flux used is brittle when cold. Water to a certain extent is a solvent of all asphalts, but from the tests of Whipple and Jackson it is quite evident that the question of solubility is a comparative one, and the tests there given show that there are classes of asphalts upon which the action of water is very slight. In this paper a quotation is made from Richardson which shows that the action of water upon coal-tar is about two-thirds of that upon Bermudez asphalt cement when expressed as the gain in weight in water in a given time. Bermudez asphalt in the tests made by Whipple and Jackson is among those which were most affected by water. A number of cases of the durability of coal-tar pitch in actual service in underground work seem to indicate very positively its suitability for this class of work. Will someone say whether or not properly-selected asphalts are unsuitable under similar conditions? Apparently the questions which need to be answered are the following:—

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* Paper presented at a meeting of the American Society for Testing Materials.

1. What kind of materials are most suitable for general application to (a) solid-floor bridges; (b) underground masonry?

2. If asphalt products are used, what should be specified?

3. If coal-tar products are used, what should be specified?

Fire-Resistant Construction and Equipment of Buildings*

THE use of the term "fireproof" is recommended to be discontinued. This general term has been erroneously applied to buildings and materials of a more or less fire-resistant or incombustible nature. Its indiscriminate use has produced much misunderstanding and has often engendered a feeling of security entirely unwarranted.

The term "fire resistant" shall be applied to all structures or materials which will satisfactorily resist the effects of a serious fire. The committee submits the following standard tests, which discriminate between fire-resistant materials and systems of construction affording "full," "partial" and "temporary" protection against fire: 1, full protection implies resistance to a severe fire for four hours; 2, partial protection implies resistance for two hours; 3, temporary protection implies a resistance to a severe fire for at least one hour.

Furniture and Fixtures

Some thirty-five years ago, when fire-resistant buildings of the steel-beam type were first erected, fear was expressed by some officials of the insurance companies of those days, that insurance against fire would soon be unnecessary. This feeling of security is still indulged in by many well meaning people who take it for granted that their lives and goods are safe, if within what was then called a "fire-proof" building, and what we now have more properly designated a "fire-resistant" building. In spite of some lamentable disasters, the popular imagination still is that the contents of a fire-resistant building will not burn, so that when flames are seen issuing from the windows of a building known as "fireproof" there are some people who will refer with derision to the "fireproof" building, and even some journals will print "fireproof but it burns."

This feeling that all depends upon the building has been reflected by those who are intrusted with the making of building laws, for though they endeavor to make building construction more and more fire resistant, they devote little or no attention to the contents. Many lives and much property have been lost due to the inflammable nature of the building's contents, and there are many instances where this loss has occurred but where little or no damage has happened to the building itself, though of the most ordinary nonfire-resistant type.

Much time and thought have been given to the planning and construction of buildings to render them fire resistant, and with good results. But with comparatively little expense greater results may be obtained by providing fire-resistant furnishings and equipments to protect the lives of the occupants and the contents of the building. There are already many buildings equipped in accordance with the standard proposed.

Recommendations

1. All solid partitions to be of metal lath and cement plaster, terra cotta, brick, magnesia, or other incombustible material. All doors with trim shall be of metal covered or other non-inflammable material, and no wood shall be used except metal-covered.

2. All glazing of sash partitions, including doors, shall be of ¼-in. wired glass in metal frames, with the balance of the construction of metal, or metal and plaster, or other incombustible material, and no wood unless covered with metal shall be used.

3. Wooden-slat partitions or slat guards back of fire-doors or elsewhere shall not be used; wire screens set in metal frames or other metal guards are suggested.

4. All shelving shall be of metal or other suitable incombustible material. Where the contents of the shelving is of an inflammable nature, the fronts of all shelving to be provided with doors of same material as shelves. If required to be glazed, the same must be done with wired glass fastened with metal independent of putty.

[illegible] All clothes lockers or closets shall be of metal, and not more than ten in one space or area, unless kept in a separate room inclosed with fire-resistant material. No wood shall be allowed except in tops where the under side must be protected with metal.

7. All stockrooms or storage rooms containing in

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* Abstract of the report of the Committee on Fire Resistant Construction, presented at the annual meeting of the National Fire Protection Association at Chicago, May [illegible].

Inflammable goods must be enclosed to the ceiling with fire-resistant material; no wooden slat partitions shall be used.

Construction Plant and Methods Employed in Re-Concreting the Lining of a Reservoir

THE work of relining with concrete the west basin of the Eden Park reservoir of the Cincinnati waterworks, which is now nearing completion, is described in a recent issue of our Chicago contemporary, Engineering and Contracting, by Kenneth C. Crain. The article presents several interesting constructional features. Mr. Crain explains that the work was undertaken last July under a 152-day limit, with a subsequent extension of 47 days, but this time, as is evident, proved inadequate.

The principal cause of the delay was the difficulty experienced in removing the old concrete, which was laid in 1876, and which averaged 18 ins. in thickness. In some parts it could be handled with pick and shovel, but for the most part its removal required the use of dynamite, and this while effective, was somewhat slow. The method used was, starting from the top, to drill holes under the concrete at varying distances apart, and as deep, or long, as 6 ft. The charges varied from half a stick to a stick to each hole.

The old concrete was left in the bottom of the basin, after a thorough testing to develop any possible weak spots. This was done by using a 14-ton roller, which traversed every portion of the basin without causing any yielding. It was assumed that this test gave an ample factor of safety for the greatest possible load of water, the maximum depth of water under service conditions being 40 ft.

The object of relining the basin was to prevent seepage of the water contained in the reservoir which, it is stated by the city authorities, sometimes amounted to as much as 2,000,000 gals. a day from the two basins. The capacity of the west basin, on which the work is now going on, is 50,736,000 gals., and that of the east basin, which is to be similarly treated, is 44,097,000 gals., indicating a daily loss by seepage of nearly 2 per cent. of the total capacity.

The new lining, therefore, is designed to be as nearly waterproof and watertight as it is possible to make it. For this purpose, therefore, it is constructed under the following specifications, in brief: Graded, as far as necessary to secure a smooth surface on the slopes, and a course of 6 in. of crushed rock, from 1 to 3 ins. in greatest dimension, applied and tamped solid. Upon this is laid a preparation of heavy felt, impregnated with asphaltum, and about ¼-in. thick, made by the Barber Asphalt Company. This waterproofing comes in strips 15 ft. long and 4 ft. wide, and is laid with 6-in. laps, connected together with pitch.

Upon this is placed a 6-in. slab of concrete, in 15-ft. squares, a 1-2-4 dry mix being used, the aggregate being crushed rock and old concrete, taken from the reservoir itself, 1 in. in greatest dimension and smaller. This new lining, it is believed, will make the basin absolutely watertight, thus preventing any further seepage of consequence. In order to take care of such surface waters as may find their way down under the felt, from the sides, however, 10-in. tile drains are provided. The lines of tile are placed under the bottom course of crushed rock, and led to a sewer outlet in the center of the basin.

The placing of the concrete on the slope sprobably basin has been a simple matter. After the crushed rock layer is rolled and the felt placed upon it and allowed to become fixed, the mixture is wheeled to place in two-wheeled steel hand-carts. Fifteen-foot steel plates, ¼ in. thick and about 7 ins. wide, wired together, are used as forms. The thickness of these forms provide space between each square, after their removal, for a pitched joint. A separate ¼-cu. yd. mixer takes care of this part of the work. It is operated by a 10 h.p. motor.

The 85-ft. slopes, however, have presented greater difficulties in every phase of the work. The necessary re-grading, after the removal of the old concrete with dynamite, could not be done with a roller or any other of the usual equipment, on account of the steep pitch, running as high as 45 deg. in many places; and this, therefore, was necessarily pick-and-shovel work. Likewise, the work of settling the crushed-rock bottom course had to be done by hand-tamping.

The placing of the concrete on the slopes, probably presented the most difficult problem of the entire job, not as being of a complicated nature, but as offering obstacles to speed. The concreting plant finally evolved by the company consisted of a single traveller, bearing all of the washing, handling, conveying, crushing and mixing equipment.

The crusher on this traveller was used only as long as the old material held out, crushed rock being hauled to the job since that time. A clam-shell bucket, operated from a boom by an engine on the traveller, lifts sand and crushed rock from the piles alongside the traveller to an upper level, from which they are chuted to the mixer as required. A ½-cu. yd. mixer is operated on this part of the equipment, dumping into a bucket which is lifted to the proper point on the slope by a boom working on a frame extended from the traveller.

The concrete, poured from this bucket is placed to the desired thickness by men with hand-tools, and, being a stiff mix, has given little trouble from sliding after placing. At the bottom of the slopes, however, when the concrete is laid on the slope before the bottom concrete has been placed, heavy timbers are used to prevent any movement of the material.

The work required 6,220 cu. yds. of concrete, and about an equal amount of crushed rock for the bottom course. The contract price of the work was about $102,000. The work will probably be completed in a short time. The arrangements for similar work on the east basin have not been made, but this contract will probably be let shortly after water is turned into the section of the reservoir on which work is now going on.

Nelson, B.C., is spoken of as the probable centre of the location of a zinc plant. Mr. W. McA. Johnson, of Hartford, Conn., inventor of an electric process for the smelting of complex zinc ores, visited Nelson recently accompanied by Dr. Struthers, a prominent New York mining man, and Dr. Barlow, formerly of the Dominion Geological Survey, and now lecturer in the Mining Department of McGill University. The feasibility of establishing the plant at Nelson was discussed with the local Board of Trade.

The Des Moines River viaduct of the Chicago, Milwaukee & St. Paul Railway, three miles west of Madrid, Iowa, is 2,394 feet long and 130 feet in maximum height. It consists of 40-ft. tower spans, 70-ft. intermediate spans, and two 155-ft. truss spans across the river. Most of the concrete pedestals are supported on piles. The layout work was done by means of repeated horizontal measurements with a 100-ft. steel tunnel tape. A spring balance was used and the tape was supported every 33 feet. Corrections were made for temperature. At each measurement point an 8-in. oak post 5 ft. long was set in the ground and a zinc plate tacked on top. This enabled the establishment of an accurate and permanent point. Independent lines were run, establishing the 100-ft. stations, and the bents were checked from these points. At the end, close measurements were also taken as a check. Much of the measuring was done at night in order to secure the benefit of a more even temperature. The layout provided for a normal temperature of 70 deg. Concrete benchmarks extending 5 ft. into the ground were placed so that direct readings could be made from benchmark to every pedestal, and these were checked independently by three sets of levels, run at different times by different men, there being no greater variation than 0.008 in. between the different elevations at any bench mark.

The First Canadian and International Road Congress at Montreal

(Staff Report)

THE promoters of the First Canadian and International Roads Congress, held in Montreal from May 18 to 23, may be congratulated upon the large attendance of delegates from all parts of Canada and the United States. The Congress had the support of the Federal and Provincial Governments, the City of Montreal, and many public bodies. The papers read were excellent, and if the delegates did not add to their stock of knowledge it was not for the lack of pointers which were offered. Many of the men who took part in the proceedings are recognized as the highest authorities on different branches of highway engineering, and their papers nearly all insisted on the urgency of expert advice being sought if the expenditure on roads is to result in permanency and economy.

The Arena, where the conference was held, was artistically decorated, and the auditorium (where the papers were read) was one mass of British, American, and French bunting.

The Opening

The opening ceremony was a very successful function. The speeches were all to the point, and emphasized the growing importance of the good roads movement. Welcome to the delegates were given by Sir Francois Langelier, Lieut.-Governor of Quebec; Sir Lomer Gouin, Premier of the province; Bishop Farthing, and others.

Mr. U. H. Dandurand, the president, occupied the chair.

In opening the Congress, Sir Francois Langelier spoke of the importance of good roads to the farmer and to the city man. He pointed out that it was only a comparatively short time since people began to turn their attention to this subject; formerly the people in the country districts neglected their roads, and refused to appoint competent engineers. The coming of the motor car had caused a revolution in road-making, and although there had been a prejudice for fear that the city people wealthy enough to own automobiles would get most of the advantage they were beginning to see that the roads would be of inestimable advantage to themselves. These bad roads were one of the most potent causes in driving people from the country to the city. Sir Francois praised the Gouin Government roads policy in lending money to municipalities who were to pay two per cent interest on it, and the Government the principal and the rest of the interest.

Sir Lomer Gouin declared that the province was ambitious to have roads which were second to none in the Dominion, and expressed the opinion that Quebec had shown more progress than any other province. In order to carry out the work they had created a special department. Turnpike trusts were sometimes criticised but they were a necessity of their time. The Government had spent a large sum of money on roads, but much more remained to be done.

Hon. Louis Coderre brought a message of encouragement from Mr. Borden. They had every hope that differences between the Federal and Provincial governments would be smoothed out.

Hon. J. A. Tessier, Minister of Roads in the Gouin Cabinet, the Hon. Honore Mercier, and Ald. Leslie Boyd, for the City Council, welcomed the delegates.

The Conference

Only two papers were read on the opening day—one by Mr. W. A. McLean, Commissioner of Public Works of Ontario, who dealt with "Highway Legislation." He spoke of the neglect of roads in former times, and said that in looking into highway legislation it was not possible to superimpose upon any country the code that belonged to some other country. They had to study the peculiar conditions of each country, and accept the code of any country in so far as it would apply to their own circumstances. Mr. McLean then referred in detail to the system of highway legislation in Ontario, by which the expenditure was divided, and went on to say that the road work should be in charge of permanent men. The city should help pay for public highways, municipal self-administration should be encouraged, and the central administration should come in at certain points to help.

Mr. A. N. Johnson, Chief State Highway Engineer, Springfield, Illinois, took as his subject "Planning a System of Public Roads." His chief contention was that the very first necessity in road construction was to make a plan of the work that is to be done over a wide area, so that in the future years whatever work was done, they would be working on a recognized system which, when completed, would be twice as valuable from its very unity. He stated that people must be prepared to spend more money, as changed conditions required a more durable form of construction. Mr. Johnson also discussed brick and concrete roads and their relation to the class of traffic which had to be provided for.

Five papers were read on Tuesday, May 19th. After an opening address by Mr. U. H. Dandurand, Mr. W. A. McLean, presided. The first paper was on "Important Considerations entering into the Selection of Pavements for Roads and Streets," by Mr. W. H. Connell, chief of bureau department of public works, Philadelphia. It was admitted, he said, that highway engineering had not kept abreast of the time as compared with the standard set in other branches of engineering work. As a matter of fact the problem that presented itself through the advent of the automobile, which had resulted in revolutionizing traffic conditions, was only just beginning to be solved, and it was equally true that it had never received the attention it deserved, and was generally looked upon lightly by both the engineering profession and public officials. The highway departments afforded a splendid opportunity to parcel out jobs to men from all walks of life and without any qualifications for the work. Highway work as an engineering problem was still in its infancy, and public officials and the public generally had yet to be educated to the point where they would appreciate that this branch of engineering work required special study, and that haphazard statements which were not based on experience or a knowledge of the subject were just as unwarranted as they would be in connection with any other scientific subject or business enterprise. Enormous sums were being wasted, and agitations and investigations going on in different highway departments, which would make it appear to the general public that engineers were not solving the problem. To a certain extent this was true, but not because the men who had made a special study of this branch of engineering had not the ability to build good roads and pavements, but because it was not under their control. This state of affairs, which usually had its origin in highway departments being run by officials who had not any experience or training to qualify them for the particular work, was the side of the subject which was more generally before the public. It was only through meetings of this kind that the public would come to appreciate the necessity of placing the highway engineering problem in the hands of men of experience and qualifications for controlling work of this kind. In other words, highway engineering must be put on the same plane as all other lines of business and professions and branches of the engineering profession. Next in importance to the personnel they should in building a road give careful consideration to the drainage, the traffic and probable future traffic of the road, the foundation on which the road would be built, the gradient, the social, local and sanitary conditions and the wearing surface required.

Valuable Papers by Major Crosby and Mr. E. A. James

In a paper on "Points Worth Noting in Connection with Road Improvements," Major W. W. Crosby, consulting engineer, Baltimore, Maryland, stated that there was too often an apparent insufficient comprehension of the importance of organization of the administrative and executive forces under the laws governing the work. It had been too often the practice to attempt to expand the old organization by adding new units of the same character to it, so as to carry on the new work, when what should have been done was to recognize the different characteristics of the new work, and to reorganize the entire department so as to provide such a machine for the combined operations as would properly and efficiently produce the results desired. In discussing the question of the selection of the methods and materials to be used itself, Mr. Crosby declared it was useless to look for a permanent road if by the expression was meant a road that would not require yearly expense for its up-keep. It would only too frequently be found to be the case that mistakes from the point of view of expenses had been made by the vain attempt to secure regardless of cost a "permanent" road surface, and that a saving would have been made, had a cheaper surface been relaid and replaced as needed from time to time. This was especially true where traffic conditions were in a changing state. It was of the most importance that the sub-grade, on which macadam was to be spread and built, should be made firm and even before the macadam should be spread. The importance of this specification was often not realized by inexperienced engineers and contractors. The proper rolling of the macadam material was too often slighted.

Mr. E. A. James, consulting engineer, York County Highway Commission, Toronto, was unable to be present, but he sent a paper which was read by Mr. W. Hubert, who explained the great results obtained by Mr. James in that county, and the demonstration given by his experience that adequate maintenance was as much needed as good construction. Mr. James stated that nine-tenths of the objections to macadam roads arose from an improper observance of the rules which govern their maintenance, and not from difficulties of construction. He gave a list of the various agencies tending to destroy such roads, giving a special word of disapproval to the narrow-tired vehicle with its tendency to form ruts which in turn interfered with lateral drainage and so impaired the road. He described the characteristics of a good macadam road that would require least attention and expenditure to keep in shape, and favored the patrol system of maintenance, finding both the statute labor and the contract labor systems of upkeep unsatisfactory.

Other papers were "Good Roads as a Factor in the Progress of Cities and Towns," by Lt.-Col. W. N. Ponton, Hon. President, the Ontario Associated Boards of Trade, Belleville, and "L'Organisation Administrative des Routes de France," by R. Lehmann, engineer of the French Government Service, New York City.

On Tuesday evening the delegates dined at the Windsor Hotel, when speeches were made by Sir Francois Langelier, the Hon. Louis Coderre, Hon. J. A. Tessier, Mr. J. W. Levesque, M.L.A., I. S. Pennybaker, executive assistant American Highway Association, Mr. W. A. McLean, Controller McDonald, Mr. O. Hezzelwood, and Mr. A. G. Batchelder, chairman of the American Automobile Association. It was announced by Mr. Tessier, for the Quebec Government, that they intended to help the various counties secure a complete road outfit for the making and maintaining of good roads. He also announced that the Government would make a grant to the Congress.

Mr. L. S. Pennybaker, executive assistant, Washington, of the American Highway Association, presided at Wednesday's session.

Mr. C. L. Shorey, chairman of the Good Roads Committee, Beaconsfield, P.Q., spoke of the progress made in his town, and of the impetus given to improvements in his district by the good roads movement.

Mr. L. R. Ferguson, C.E., assistant secretary, Association of American Portland Cement Manufacturers, Philadelphia, read a paper on "Concrete Roads and Sheets." He pointed out that the opposition to good roads arose in many instances to the cost of maintenance. This cost was the greatest economic factor in the good roads movement. The speaker gave instances of the maintenance cost of concrete roads, showing that these were low, and that concrete was an ideal material for county highway purposes. Concrete, too, was reasonable in first cost. Horses were able to pull heavier loads over concrete roads than over those made of other material. The whole width of the road was available, and there was no tendency to use the middle of the road. The rapid increase of motor trucks had made concrete roads a necessity.

"Modern Bituminous Surfaces and Bituminous Pavements," was the subject of a paper by Mr. Arthur H. Blanchard, M. Can. Soc. C. E., Professor of Highway Engineering, Columbia University. He explained the methods of bituminous construction, bituminous surfaces, bituminous macadam pavements, bituminous gravel pavements, and bituminous concrete pavements,—and emphasized the importance of a clean surface before the imposition of bituminous material was made. The tendency in this country was to go a long period before the re-application of bituminous material. Many engineers were now practising an annual renewal of surfacing material. There was a difference of opinion between American and European engineers as to the necessity for the surface being dry, and his experience was in favor of dry surfaces. There should be a thorough compaction of broken stone before the application of bituminous material. Professor Blanchard also described the various machines in use, and insisted that engineers should see that the materials were suitable for the conditions under which they were to be used.

Professor A. T. Laing, University of Toronto, in a paper on the "Technical Training of Highway Engineers,' alluded to the technical training of highway engineers on the European continent. On the American continent there had been, in the past, a disposition to pay little attention to this branch of engineering, with the result of waste and poor roads. In the United States remarkable progress had been made during the last few years, and in Canada they had made advancement, so that highway engineering was given a prominent place in the curricula of nearly all technical colleges throughout the Dominion. The status of the highway engineer must be recognized and the rewards for his services made commensurate with the high office he was called on to fill.

In his paper on "The Economy of a Vitrified Brick Road," Mr. W. P. Blair, secretary of the National Paving Brick Manufacturers' Association, Cleveland, Ohio, stated that the original cost of a brick road was not necessarily excessive. The cost of grading, drainage, bridging, and the entire preparation for placing thereon the artificial and wearing surface, should be alike for all types and was therefore no more expensive for a brick road than was required for the least expensive type of wearing surface. This necessary preparation in the case of a brick road bore a feature of economy that was well worth mention. It was not readily injured either from wear or tear or from any character of climatic influences. With the brick wearing surface placed upon it, ample protection for the durability of all the work incident to such preparation was afforded. The life of a brick roadway could be estimated to be much beyond that of a generation.

Mr. R. A. Meeker, engineer, Department of Public Works, State of New Jersey, read a paper on "Road Designing."

It was decided at Thursday's session to organize a permanent association with the object of holding annual Congresses. The following officers were elected. Hon President, Mr. U. H. Dandurand, Montreal; President, Mr. W. A. McLean, Toronto; first vice-president, Mr. D. Michaud, Quebec; second vice-president, Mr. O. Hezzelwood; the following were also elected as the members of a board of directors: Messrs. H. W. Pillow, Montreal; J. W. Kerr, Vancouver; Lieut.-Cal. W. N. Ponton, Belleville; Ald. R. J. Shore, Winnipeg; S. R. Henderson, President of Manitoba Good Roads Association; and Mr. J. Duchatel, engineer, Town of Outremont, P.Q.

Invitations to hold the next Congress were received from Toronto, Ottawa, Winnipeg, and Quebec, and these will be considered by the officers.

The relation of the motorist to the good roads movement was a prominent subject in the papers presented. Mr. O. Hezzelwood, chairman of the Canadian Automobile Federation, Toronto, and Mr. Robertson, secretary of the Ontario Motor League, read papers bearing on this question.

"The Bulk Handling of Cement" was the subject of a paper by Mr. H. M. Capron, president of the Marsh-Capron Manufacturing Company, Chicago. He stated that the use of cement in bulk was comparatively new. His interest and experience with bulk cement started with the mechanical problems involved in handling and storing the cement and other aggregates at the mixing plant, the measuring and conveying them to the mixer, and the handling of the concrete. Some of the large cement companies and a few progressive contractors had been studying this problem and it was significant that once a contractor had used bulk cement, he became one of the most enthusiastic converts. It required no little originality and a great deal of courage to depart from a custom of years' standing in any line of business, and such a departure must of necessity be founded upon logic which was absolutely sound. Mr. Capron described the system of handling bulk cement, pointing out that the elimination of the sack on the job would be a great boon. If besides securing this advantage, the contractor found himself relieved of a large item for labor in handling these sacks, both empty and full, there was no question that his best interests demanded that he use cement in bulk wherever possible.

In a paper on "Modern Highway Bridge Construction," Mr. L. E. Allen, C.E., consulting engineer, County of Hastings, Belleville, Ont., pointed out that good bridges were essential, as the tonnage over good roads would rapidly increase, thereby requiring more substantial bridges. Economy in good roads construction as well as in bridges could not be obtained by temporary or poor workmanship, and while it might seem to some that the initial cost of a good road or bridge was an indication of economical construction, too many instances of the false economy on low initial cost, with the resulting high cost of maintenance might be found to prove this statement. The other statements in the paper closely followed the lines of Mr. Allen's article in a recent number of the Contract Record.

Mr. Controller Church and Mr. D. Michaud, Deputy Minister of Roads, Quebec Government, were among the speakers, while the following papers were also read: "Modern Road Construction in the United States," by Mr. T. H. Boorman, secretary, American Society of Engineers, Architects and Constructors, N.Y.; "L'Association Internationale des Congres de la route, son organisation, son utilite et son role," by Mr. J. W. Levesque, M.L.A.

THE EXHIBITION

Not the least interesting section of the Congress was the exhibition of road machinery, etc., probably one of the most complete collections of machines, tools and material ever seen in Canada. While it had its purely publicity side, it also had an educational value, as those interested in road work were able to inspect the very latest and most economical methods of doing work.

The largest space was taken by Mussens, Limited, Montreal, who showed many lines of machinery. Here were displayed an enormous stone crusher, made by the Austin Manufacturing Company, of Illinois, together with other products of the same company, including a motor roller, grader, sprinkler, bins, sweeper, wagons and dump wagons. Mussens, Limited, also showed portable boilers, manufactured by the A. B. Farquhar Company, York, Pa.; gasoline engines and pumps, made by the Novo Engine Company, Lansing, Mich.; gasoline pumps, made by A. A. Parker, Waterford, N.Y.; Ruston, Proctor & Company's (Lincoln, Eng.) steam roller; Holman Bros. (Camborne, Eng.) rock drills; Hardy hammer drills, manufactured by the Hardy Patent Pick Company, Limited, Sheffield, Eng.; Meaford wheelbarrows, Sterling wheelbarrows; an electrically driven Smith concrete mixer, equipped with an automatic side loader and auto water tank and power filling device; Meaford road and pick ploughs; and Barrows' & Company, Banbury, Eng., street sweepers—altogether a complete exhibition of road machinery.

The General Car and Machinery Works, Montmagny, Quebec, was another concern having a large exhibit. Their products have the merit of being all made in Canada, and comprised a complete outfit of road making machinery. The stone crusher is claimed to be the only type fitted with a jaw crusher running with a crank shaft and a connecting rod instead of an eccentric shaft, and a following roller. A feature of the crusher is the toggle shaft and sleeves which are easily replaced when the parts become worn. There is an all-steel-bin, screen and elevator, the whole outfit being put up on the ground in running shape. The equipment includes a steam road roller, a portable engine, steel sprinkler, steel plough and steel grader. A steel drill was also shown, together with wagons for spreading and carrying stone. The outfit shown has been purchased by the Town of Lachute, P.Q. The company was represented at the show by Mr. J. H. Paquet, the secretary-treasurer.

The Foss & Hill Machinery Company, Limited, were exhibitors of a Standard drum London concrete mixer, on trucks, with power loader, steam engine and boiler, also an automatic batch mixer with Standard gas engine. The London Concrete Machinery Company, Limited, of London, Ont., are the largest makers of concrete machinery in Canada.

One of the most tastefully decorated booths was occupied by the Aztec Oil and Asphalt Refining Company of Canada, Montreal. The product is of Mexican origin, and the booth was draped with material of Mexican design and coloring, and also decorated with souvenirs from that country. The company showed pictures of thoroughfares paved with Aztec asphalt and streets oiled with Aztec liquid asphalt. Several samples of the products were on view. Mr. J. R. Draney, general sales manager of the Interocean Oil Company, New York, Mr. Gordon Smith, Albany, N.Y., and Mr. E. Slade, Montreal manager, were in attendance.

The Marsh-Capron ("most mixing-least fixing") concrete mixer was shown by the Canadian Fairbanks-Morse Company. One of the points of this machine is the steel rail tracks fitted round the drum, which it is claimed run true and wear four or five times as long as cast iron tracks. The main drum gear is built in sections bolted in place. The Canadian Fairbanks-Morse Company also had on view the "Little Devil" mixer, and wagons made by the Glen Falls Wagon Company. A five-ton pitless scale, made by the Fairbanks Company, was another exhibit; while other lines were wheelbarrows, concrete carts and tools, pumps, wire and manilla rope blocks, and Milburn acetylene lights.

Concrete roads are coming more and more into use, and the Canada Cement Company had an exhibition illustrating the widespread area in which these roads have been laid down. By means of electrically-illuminated hand painted transparencies the various uses of concrete were shown. There were pictures of roads in the stages of construction, bridges, houses, etc. The company also exhibited a section of concrete pavement, giving the construction of transverse joints, method of reinforcing, and surface finish. Besides this there was a number of photos of Canadian streets, from Montreal to Edmonton, built of concrete. A novelty was an imitation rustic bench of concrete; every detail of a rustic birch bench had been followed out, and it was almost impossible to tell it from a bench of birch construction.

The Paterson Manufacturing Company, Montreal, had on view three samples of tarvia—one for road construction, another for reinforcing old roads, and the third for dust laying. There were also illuminated transparencies of roads in course of construction and finished, on which tarvia was used.

The Pedlar People, Limited, had some of their widely-known specialties on show. Thus there was material for all-steel buildings, for corrugated iron culverts, and Clinton electrically-welded wire used in the Clinton system of fireproof construction and concrete reinforcement, which has now been in use for some years.

There are now about 300 Troy wagons doing service in Montreal. The agents in the city are McNally & Company, Limited, who had on view one of these dump wagons. Mr. H. C. Tattersall, who is one of the Troy Waggon Works Company's special representatives, was looking after their interests at the show. At the booth there were many photos of the company's various types of waggons.

The Dunn Wire-Cut-Lug Brick Company, Conneaut, Ohio, were showing some of their productions and photos of roads where the bricks are used. This company are among the important manufacturers of paving brick in the United States, and have the largest continuous kiln in the world; with the additions now being made it will total 3,300 feet. Several Canadian jobs have been completed, amongst them being one in Toronto. The Montreal agents are the Stinson-Reeb Builders' Supply Company, and the Toronto agent G. W. Essey. The brick makes a firm highway, and allows the grout to get down, also giving a smooth surface. It is in extensive use in the United States.

Alexander Bremner, Limited, is one of the oldest supply houses in Montreal. The products exhibited included drain pipes, contractors' wheelbarrows, cement tools, paving bricks, etc.

A large variety of samples of road-making materials was to be seen at the booth of the Elder Ebano Asphalt Company, Limited, of Montreal. These included "Mexican Ebano," Mastic asphalt, rock asphalt, artificial blocks of all shades, granite, "Danforth" pink stone, bricks of all colors, and "Ebano Asphalt."

A new firm to the Dominion is the Decauville Flexible Armour of Canada, of Montreal. They sell a patent protection for dykes, embankments, etc., which consists of a strong network of cement bricks, with two holes in them. The bricks are connected together by wires (made of steel for fresh water, and of aluminium for salt water) by means of laying keyboards or gauges which enable the workmen to construct the network making up the armour. The company had on show samples of the brick and of the completed network.

Baker-Barron, Incorporated, are manufacturers of road machinery, including "Strait's" caterpillar tractor, the 20th century sweeper, 20th century four-wheel scraper cyclone ditcher, and the two-can carrier. Some of these were on show.

Other exhibitors were the Thomas Davidson Manufacturing Company, Limited, Montreal (enamelled steel and lithographed metal signs, street names, etc.); the Albion Motor Car Company of Canada (a gasoline dumping truck); Jones & Glassco (Foden Steam Wagon); Canada Creosoting Company, Limited (creosoted wood paving blocks, railroad ties and bridge trenches); British American Oil Company, Montreal (petroleum products, asphaltic road oils); J. I. Case Threshing Machine Company (road machinery); and Imperial Oil Company (road oils and asphalt binders)

Through the courtesy of Mr. W. A. McLean, the Ontario Government exhibited a series of miniature models, showing the development of road building.

During the evenings representatives of some of the exhibiting firms gave talks on their various products. The speeches were made the more interesting by means of moving pictures and lantern slides. Mr. Van Scoyoc, of the Canada Cement Company; Mr. De Wind, of the Austin Manufacturing Company; and Mr. P. P. Sharples, general manager for the United States and Canada of the Paterson Manufacturing Company, were among those who spoke.

LETTERS

Waterproofing Problems

Editor Contract Record:

In a recent issue of the Contract Record (April 8), I notice an interesting article on Waterproofing, by Mr. L. G. Mauer. In his article Mr. Mauer recommends mixing a chemical solution with cement mortar. I shall be glad if you will kindly inform me what this chemical is and where it may be obtained.

Yours very truly,
A. E. CARTER.

At our request Mr. W. H. Evans, waterproofing expert with Messrs. Dartnell, Limited, Montreal, offers the following solution:

"In making concrete block the cement should be waterproofed before it is added to the sand, or other aggregates according to the waterproofing manufacturer's directions. Waterproofing should be of a colloidal nature which will lubricate, or assemble the aggregate into one dense mass. The cause of the free lime appearing on the surface is due to uneven cementation caused by the quick evaporation of water before the cementation process is complete. The colloidal waterproofing will retain a certain amount of excess water in the mass until the limes existing therein are thoroughly fed. Then it creates by the evaporation of this water a chemical action, or crystallization, which closes all pores or fibrous channels which otherwise would allow the free lime to be drawn to the surface by the moving air. Besides, it will make the blocks absolutely waterproofed and impervious to the weather."

Mr. Evans suggests the use of "Toxement" and informs us that this material is now being used on a concrete foundation for Messrs. Canadian Vickers, Limited. The building is on the St. Lawrence River and will have to stand an eight-foot head pressure. The watertightness of the building is guaranteed for five years—a proof of the faith which the proprietors have in the qualities of the material.

Personal Mention

Mr. Robert J. Marshall has been appointed town engineer of Trenton, Ont.

Mr. Frank Barber, consulting engineer, Toronto, and Engineer to York County, has been engaged as township engineer of Etobicoke.

Mr. A. R. Moore, resident engineer, Kettle Valley Railway, Kelowna, B.C., has become an associate member of the American Society of Civil Engineers.

Mr. W. W. Smith, assistant engineer, Grand Trunk Railway, Montreal, Que., was recently elected an associate member of the American Society of Civil Engineers.

Mr. McC. P. Blair, city engineer, St. Boniface, Man., has been transferred from the associate to the membership section of the American Society of Civil Engineers.

Mr. F. L. Macpherson, municipal engineer, Burnaby municipality, Edmonds, B.C., has been elected an associate member of the American Society of Civil Engineers.

Mr. Wilfred Brereton, who is a 1903 graduate of the School of Practical Science, Toronto University, has been appointed City Engineer of Winnipeg, at a salary of $6,000 a year. Mr. Brereton has done considerable engineering work in Toronto and Hamilton during the last ten years.

Mr. J. E. Pennybacker, until recently secretary of the American Highway Association, has rejoined the Office of Public Roads in the capacity of chief of the division of road economics.

Mr. George H. Herrold, Assistant City Engineer of St. Paul, Minn., has been selected to represent that city at the international conference on city planning to be held in Toronto, Ont., on May 25 to 27.

Mr. Leonard Andrews, M. Inst. C. E., managing director of the Canadian British Engineering Company, Limited, has arrived in Winnipeg from England to succeed as Canadian manager Mr. Reginald Porter, who returns to London, Eng., to resume the management there.

Mr. Chas. G. Toms has received an appointment as general manager of the Toms Contracting Company, Limited, Toronto. A graduate in Civil Engineering of the University of Toronto, Mr. Toms has had considerable experience in construction work, mainly in concrete and building construction.

Mr. D. H. Mapes has been appointed Superintendent of Building Construction for the Canadian Pacific Railway, according to an announcement from the head office of the company at Montreal. For many years Mr. Mapes was vice-president of J. V. Schafer, Jr., & Company, a well-known contracting firm of New York City. He entered the service of the Canadian Pacific Railway in July, 1912, as assistant to Mr. F. L. Ellingwood, who was then superintendent of building construction. Mr. Mapes' appointment to the office follows Mr. Ellingwood's resignation.

Mr. J. W. Evans, who was appointed recently as City engineer and manager of waterworks, street and sewer departments, of Belleville, Ont., has had an extensive experience in railway and mining engineering work, and has also served as town engineer for Deseronto, Ont. He was formerly chief engineer for the Bay of Quinte Railway Company, and built that line between Deseronto and Napanee, and between Tweed and Bannockburn. He also built the extension of the Central Ontario Railway between Ormsby and Bancroft. He conducted a general civil and mining engineering practice at Cobalt from 1906 to 1909, and from that time up to April 20 of this year was connected with the engineering and surveying firm of Evans & Evans, of Belleville and Thornton.

At Westmount last week there occurred the death of Mr. John Laurie, who for forty years was connected with the engineering firm of John Laurie & Brothers and later with the Laurie Engine Works. Mr. Laurie was born in Montreal over eighty years ago.

Mr. John Graham Steacy, a railroad contractor of continental reputation, died at Brockville on May 8, aged 77. In early life Mr. Steacy was associated with his father in the erection of passenger stations and engine shops along the line of the G. T. R. He was senior partner in the firm of J. G. Steacy & Company, which built the first fifty miles of the European & North American Railroad running out of St. John, N.B. He also had important contracts on several railroads in the United States.

Senator William Gibson, who died recently at Beamsville, Ont., was for over twenty years in charge of masonry construction on the Grand Trunk system in Canada. He also took an important part in bridge construction, having supervised the building of the approaches and portals to the Sarnia tunnel, and the Victoria Jubilee bridge at Montreal

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

A new storey is to be added to the Montreal City Hall, and the offices are to be re-arranged. The engineers' department is to have new quarters.

Operations for constructing a highway from Sherbrooke, P.Q., to the boundary line have been commenced by O'Brien & Doheny, contractors, Montreal.

The Toronto Harbor Commissioners have several dredges in operation at present in connection with the extensive harbor improvements for which several contracts have already been let.

A Trade and Labor Congress is to be held at St. John, N.B., in September. About 350 delegates will attend from different parts, including representatives from Great Britain and the United States.

A bill to create a Water Power Commission, consisting of three commissioners and a secretary, to investigate the possible source of water power for hydro purposes has been entered in the Nova Scotia legislature by Premier Murray.

There is a good deal of constructional activity in Hamilton at present. Two business blocks are in course of erection and numerous other buildings are contemplated. Street improvements are also to be pushed forward, notably the asphalt paving of Balmoral Avenue.

The city of Hamilton has another industrial concern in the newly-incorporated National Rubber Company, Limited. This firm, which has a capital of $500,000, will manufacture all kinds of rubber goods. The local men interested include Dr. George Weing and Mr. Frank E. Walker.

The Montreal Board of Control has recommended to the city council the construction of a tunnel under the Lachine Canal, at the point where it is crossed by the Wellington bridge. This is said to be the only means of relieving the traffic congestion existing in the Point St. Charles section of the city.

Mr. G. B. Reynolds has removed from the Coristine Building, Montreal, to Guarantee Building, Beaver Hall Hill. Mr. Reynolds is the eastern representative of the Trussed Concrete Steel Company, Trus-Con Laboratories, Northwestern Terra Cotta Company, and President of the Hadrian Flooring Company.

Operations on the filling in of Ashbridge's Bay, part of the undertaking to improve the Toronto water front, have commenced by the contractors, the Canadian Stewart Company. This particular work will take four years to finish, and about 14,000 piles will be driven. The Harbor Commission system of pile driving will be the use of a powerful blast of air forcing the piles down, while the Canadian Stewart Company will use a battery driver which will place four piles in position at a time.

The Public Utilities Commission at Montreal, Que., has decided that the city conduit plans provide for insufficient ventilation of the St. Catharines Street section. The Commission's objection will be laid before the Electric Service Commission. It was announced by Mr. J. L. Perron, K.C., representing the Montreal Public Service Company, that $400,000 would be expended by the city on laying the St. Catharines and Bleury conduit, and that the different companies interested would spend $600,000.

At Ottawa a construction company has been formed to build working men's houses to sell on the easy-payment system. The company will have a capitalization of half-a-million dollars. It is intended to manufacture nearly all the building materials and a brick plant will be started by the new firm near the cement works in Hull, Que. Negotiations have been completed for quarries of Nepean sandstone and ordinary limestone near the city. Other equipment is to include a lumber department, planing mills, and cement block plant.

With the object of giving additional encouragement to the construction of dry docks in Canada, the Dominion parliament passed a resolution recently, on the motion of Hon. Robert Rogers, providing that the subsidy payable in respect to first-class dry docks, under Section 8 of the Dry Docks Subsidy Act, be increased from 3½ per cent. to 4 per cent. per annum of the cost of works to be carried out during the next thirty-five years. This increased percentage is deemed necessary in order to encourage capitalists to invest in Canadian dry dock projects.

An International Conference on City Planning will be held in Toronto from May 25 to 27. The Ontario capital has the distinction of being the first Canadian city to receive the conference, which this year will become international in scope and character. A grant has been obtained from the Dominion Government, the Ontario government and the city of Toronto also contributing. City planning is thus recognized to be of national, provincial and municipal interest. An address will be given by H.R.H. the Duke of Connaught, who will open the Conference.

The sub-committee of the Toronto Board of Works is considering the question of water rates in the city. The levy of a special tax at three cents a foot frontage on all property in the city, providing a fund to lay water mains, is one of the suggestions put forward on the ground that the mains should be laid as local improvements. There are about sixty miles of Toronto streets without water mains, and the adoption of this suggestion would mean the availability of 663,600 feet of frontage for taxation. It is urged in opposition of the frontage tax that such a scheme would involve a heavy expenditure in certain sections of the city.

WESTERN CANADA

The Roman Catholic denomination intends to erect a substantial college in Regina, Sask., and work on the structure will probably be commenced during the present year.

The city of Regina has decided to go ahead with the building of a police station at a cost of $147,440. The contract has been let to the Frid Lewis Company, which recently opened an office in Regina.

Mr. Horwood, architect of the new block to be erected at Victoria, B.C., for the Hudson's Bay Company, visited the centre of operations recently and expressed satisfaction with the progress of excavation. The substratum of the site has proved peculiar in formation, and delay has been caused by unexpected difficulty in reaching rock bottom in the excavation at the northwest corner. The pouring of concrete will commence in a few days. Most of the steel is already on the job.

The firm of Wettlaufer Bros. of Toronto, manufacturers of concrete mixers and other heavy machinery, have opened a branch in Regina, Sask. They have secured temporary quarters in the old Monarch Lumber Company's warehouse, but will shortly erect a first-class warehouse of their own. The branch at Regina is the only one west of Winnipeg, and will control all the business in Saskatchewan, Alberta and British Columbia. A. E. Hodgert will be the local manager.

Word has been received from London, Eng., from the emissaries of the Burrard Inlet Tunnel and Bridge Company, that the firm of Sir John Wolfe Barry, who prepared the original plans under an agreement to have the inspection of construction of the bridge across the Second Narrows, have agreed to relieve the company from the contract. This leaves the latter free to accept one of the alternative bids submitted in April last. Most of the tenderers declared that as good a bridge could be constructed for a much smaller sum if the plans were altered slightly.

Considering the backward conditions of 1913, the prospects for building in Regina, Sask., this year are exceptionally good. Many big buildings have already been contracted for, some of which are even now under construction. The Grand Trunk Pacific Hotel and station will in all probability be completed during the present year. The excavation for the hotel was completed last year, and the footings sunk, so that everything is in readiness for the erection of the building without delay. In addition to the building work the city has a progromme of local improvement works which will require an expenditure of well over $2,000,000, classified as follows:—Water works, $360,000; water main extension, $127,752; domestic sewer extensions, $142,145; storm sewer extensions, $170,000; sewage disposal works, $61,520; street railway extensions, $250,000; pavement, $452,946; sidewalks, $65,000; electric light and power, $404,000.

The Public Works Department of British Columbia is asking bids on a large bridge to be erected over the Pitt River. The location of the bridge is at Port Coquitlam, about twenty miles east of Vancouver, and is on the route of the Dewdney Trunk Road. It will cross the Pitt River about one-fourth of a mile upstream from the Canadian Pacific Railway Company's bridge. Borings have been made across the site, which show that for a depth of 150 ft. the ground is composed of very light clay or mud, interspaced with beds of gravel or sand. The greatest depth of water at ordinary low tide is about 50 ft. and at ordinary high tide about 6 ft. more. The substructure will consist of nine concrete piers, all of which will have concrete shafts resting on timber cribs, but the two outermost piers will have timber piling in addition. At both ends of the bridge there will be timber trestle approaches, 540 ft. in length at the west end and 270 ft. at the east end. The guide pier for the swing span will be of timber piling.

The superstructure will consist of seven steel spans. The clear width of roadway on the bridge will be 16 ft., and on the trestle approaches 24 ft. The swing span will give a clear opening of 93 ft. on either side of pivot pier. When closed it will have a clearance of 24 ft. between mean high water and the underside of truss. The deck of the bridge is to be arranged to admit, at some future time, of laying steel rails for electric cars. The estimated cost of the completed bridge is $450,000. The contract for the removal of the steel spans from the Canadian Pacific Railway Company's bridge, which have been purchased for $70,000, and the placing of them on the piers of the highway bridge, has already been let.

Canadian Railroad Development

Mr. David McNicholl, vice-president of the Canadian Pacific, is visiting the west to push forward work on the construction of the Kettle Valley Railway in B. C.

At Victoria, B.C., about 4,000 men are at work on the construction of the Pacific Great Eastern railroad, according to a statement made a few days ago by the president of that railway, Mr. A. W. Stewart, who is also a partner in the contracting firm of Foley, Welch & Stewart. Recently several further contracts were awarded for the construction of different sections of the Pacific Great Eastern, Messrs. Hackman & Moore being given a section of ten miles between Kelly Lake and Clinton. Other contractors who are carrying out additional sections include Messrs. Welch & Kennedy, Rankin & Kellett, and Madden Bros.

The Dominion Government is building a line in northeast Manitoba from the Canadian Northern Railway to Port Nelson, and the provincial government of Manitoba is proposing a line north from Winnipeg to the same point. The provincial government of Ontario proposes to extend the Temiskaming & Northern Ontario Railway to James Bay (the southern arm of Hudson Bay), with a terminal at the mouth of the Moose River, at the southwest corner of the bay. The Canadian Pacific Railway is said to be contemplating an extension of its Kippewa branch north from Kippewa, Ont., to James Bay. The Temiskaming & Northern Ontario Railway already extends from Toronto to Cochrane, Ont., on the Canadian Transcontinental Railway, and has had investigations made as to conditions for establishing rail and water terminals at Moose Harbor, the mouth of the Moose River.

Publications Received

"Foundations of Bridges and Buildings," by Henry S. Jacoby, Professor of Bridge Engineering, Cornell University, and Roland P. Davis, Professor of Structural and Hydraulic Engineering, West Virginia University. Published by the McGraw-Hill Book Company, Inc., New York City. Price $5.00 net.

The authors treat in a systematic manner the entire subject of foundations for bridges and buildings, confining their observations almost exclusively to American engineering practice. Careful attention is given to piles and pile-driving, the matter presented in this connection being calculated to be particularly helpful to the young engineer. It is interesting to note a chapter on pneumatic caisson practice by Mr. T. Kennard Thomson, an experienced consulting engineer and a graduate of the University of Toronto, now in practice in New York City. Mr. Thomson's experience and observations should be helpful to all engineers and contractors of lesser experience. There are three chapters on Piers and Abutments. The book contains upwards of six hundred pages and is profusely illustrated. The headings of the various chapters are as follows: Timber Piles and Drivers, Driving Timber Piles, Bearing Power of Piles, Concrete Piles, Metal and Sheet Piles, Coffer-dams, Box and Open Caissons, Pneumatic Caissons for Bridges, Pneumatic Caissons for Buildings, Pier Foundations in Open Wells, Ordinary Bridge Piers, Cylinder and Pivot Piers, Bridge Abutments, Spread Foundations, Underpinning Buildings, Explorations and Unit Loads, Pneumatic Caisson Practice, References to Engineering Literature.

The keen competition between brewing companies has brought about the most careful study of every structural detail tending to improve quality or reduce the cost of production. The Home Brewing Company, Newark, has made a special study of these matters and, as a result, has placed a contract with the H. W. Johns-Manville Company, of New York City for the insulation of those departments requiring the most accurate regulation of temperature. The order involves complete insulation with J-M Pure Cork Sheets. These are said to contain more "dead air" cells than any other insulation on the market. They are non-absorbent, never rot or crumble, and last as long as the building they insulate.

Development of the Neponset Wallboard Industry

In 1795 George Bird, founder of the firm of Bird & Son, inaugurated the Neponset wallboard industry, which ever since has continued in the hands of the same family. This is believed to be a record in the paper and felt making history of America. From modest beginnings there has grown the present extensive organization which has two mills operating in Canada, three in the United States, besides warehouses and sales offices covering both countries and agencies in all parts of the world. The daily capacity of the mills is 300,000 lbs. of paper, 600,000 sq. ft. of roofing, and 800,000 sq. ft. of waterproof paper. The company buy their raw materials direct from home and foreign markets, and manufacture their products throughout with the most exacting system of tests, which latter are attended to by special departments. In using Neponset products for building purposes the example is followed of many large railroad systems who for years have been extensive users of the material, one system alone taking 15,000,000 sq. ft. in a year.

Neponset wallboard, the Bird substitute for laths and plaster, is made to ensure the maximum tensile strength. To eliminate the possibility of warping, which is said to result from the absorption of moisture by ¼-in. fibre boards, Neponset wallboard is claimed to be thoroughly waterproof on each surface, thus preventing moisture from getting into the board. An attractive finish is added to the surface; in fact it is made in three different finishes. Neponset wallboard can be applied immediately, a feature which commends it as an efficient substitute for laths and plaster.

Neponset proslate roofing, which is Neponset Paroid plus some additional treatment, is held to be the highest development which ready roofings have ever reached.

In addition to Neponset roofings and Neponset wallboard, Bird & Son are also manufacturers of floor covering paints, insulating paper, waterproof building papers, fibre cases, etc.

The Seattle, Wash., Branch of the H. W. Johns-Manville Co. was recently awarded the contract for supplying cork sheets for the Mainland Ice & Cold Storage Company's new plant at Vancouver, B.C. This product, which is known as J-M Pure Cork Sheets, is claimed to be the standard material for cold storage insulation. The process of making these sheets is a most interesting one and consists, in part, of compressing pieces of cork in moulds at a temperature of 500 deg.

We have just received from the Herbert Morris Crane & Hoist Company, Limited, Toronto, a copy of their new Bulletin B5, which is devoted entirely to the various types of travelling trolleys made by the firm. These trolleys are of many patterns and run either on a flat-bar track or on the lower flange of an ordinary steel I-beam. Some are prepared for short straight runways, while others, containing suitable swivels, are flexible in a horizontal direction, and thus permit of the use of curves or "bends" in the track. The bulletin contains much practical information of immediate interest to all users of this kind of equipment. The illustrations, diagrams and tables of dimensions and prices are arranged in a handy form.

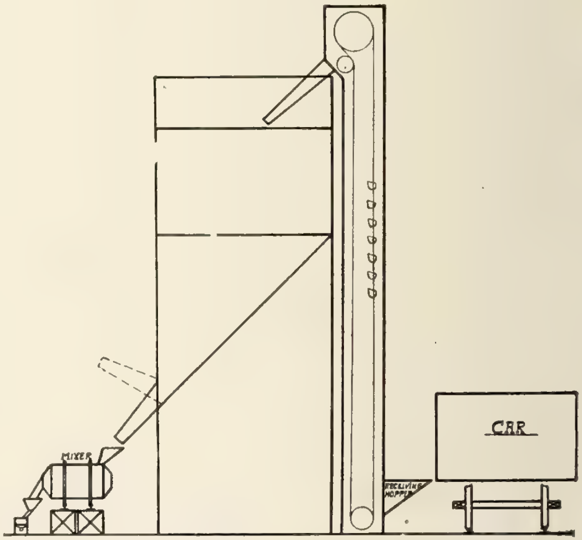
Portable Storage System

Concrete contractors and road builders will appreciate the portable storage system for handling cement, sand, gravel and crushed stone, illustrated herewith. The storage and handling of these materials in construction work frequently becomes a serious problem.

Cement must be stored in a house or under cover where it will not be damaged by the weather. The sacks must be paid for by the contractor who is allowed a pro rata amount for the sacks returned in good condition. In addition to the cost of opening sacks, there is usually a loss through injury and the additional expense of cleaning, bundling up and transportation charges back to the manufacturer.

Crushed stone, gravel and sand can, of course, be piled up on the ground. This means placing of planks, which are usually no good afterwards, or else a certain amount of loss due to the material working into the ground. Frequently, also, there is more or less bother and confusion in climbing over these piles and certainly considerable expense in putting into the piles and rehandling to get material to the mixer.

By using the Weller portable storage system, cement can be purchased in bulk, thus effecting a considerable saving in original cost and dispensing entirely with the cost of opening, cleaning and returning sacks. The entire carload of cement is elevated and stored in the cement bin which is built so that there is no danger of damage from rain or other inclement weather conditions. Likewise the other materials are stored in their respective bins, each having a capacity of one car or more, and then spouted to the mixer as required. For batch mixing, a certain sized measure can be fitted to the various chutes or the material can be spouted into the batch hopper.



—WELLER PORTABLE STORAGE SYSTEM—

For continuous mixing, automatic feeding devices can be attached to the spouts, regulated to deliver varying amounts from the different bins at the same time. By this arrangement, maximum capacity can be reached, as the unloading from cars can be accomplished at the most convenient time and a large supply of material is constantly on hand and available by simply operating a lever.

After finishing the job, the equipment can be taken down, shipped to another point and quickly re-assembled. The machinery can be operated by motor, gas or steam engine, or by any other available power.

These storage systems can be built entirely of steel, of wood, or of a steel frame with wood bins. The design and mechanical equipment are the product of The Weller Manufacturing Company, of Chicago, Ill.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Bagotville, Que.

The municipal council has decided to construct macadam road at a cost of $25,000 and tenders will be called as soon as possible.

Barrie, Ont.

The town council proposes to construct sewers in James, Ross and Sophia streets. Engineer, K. S. Macdonell.

Brantford Twp., Ont.

The township council has decided to construct sidewalks this year at an estimated cost of $23,000.

Charleswood, Man.

A by-law will be submitted to the ratepayers shortly providing for the expenditure of, approximately, $100,000 on the construction of roadways. Estimates are now being prepared.

Edmonton, Alta.

The city council proposes to purchase a sewer trenching machine at an estimated cost of $6,500.

The city contemplates installing at a cost of $27,000 a paving plant and doing most of its own paving.

Hamilton, Ont.

The city council is about to purchase a road grader.

Moose Jaw, Sask.

Tenders will be received by the city commissioners until 10 a.m. June 5th, for (85) laying about 19,000 sq. yds. street paving; (86) 295 cast iron manhole frames and covers, 200 catch basins; (87) 52 tons ⅝-in. lead pipe and 5 tons pig lead. Plans and specifications are at the office of the engineer, Geo. D. Mackie.

Orangeville, Ont.

The town council has under consideration the construction of sidewalks; also a permanent bridge on Main St. and a concrete roadway.

Oshawa, Ont.

The construction of 50,000 sq. ft. cement concrete sidewalks is being considered by the town council. Town engineer, Frank Chappell, C.E.

Tenders will be received by the town engineer, Frank Chappell, C.E., until May 29th for the laying of 50,000 square feet of cement concrete sidewalks.

Ottawa, Ont.

Tenders will be called this week by the city council for the delivery, within 3 weeks, of a 12-ton steam roller.

Surveys have been made for the laying of wood block pavement on Henry St. between Augusta and Coburg streets.

The city council is asking for tenders for the supply of a steam roller. Plans and specifications are with the secretary of the board of control.

The city council have under consideration the laying of asphalt pavement on Stirling street between Wellington and Scott streets, and on McLaren street between Elgin and Cartier streets.

Port Alma, Ont.

Plans are being drawn by the Union Gas Company for the construction of a pumping station at an estimated cost of $7,000.

Prince Albert, Sask.

Tenders are being received by the engineer, Augus Smith, City Hall, for metering all the water services.

Tenders will be received by the city clerk, J. B. Brown, until 1 p.m., June 1st, for the construction of 36,000 ft. 4-in., 6-in., 8-in., 10-in., 12-in. and 15-in. sewers.

Stamford Twp., Ont.

Tenders will be received by the engineer, J. C. Gardner, Niagara Falls, for about 2 miles cast iron and steel pipe of from 2 to 8 inches in diameter.

Stratford, Ont.

Plans for extensions to the sewer system are being drawn by the city council.

A by-law providing for the expenditure of the sum of $10,000 on improvements at Agricultural Park has been passed by the city council.

The time for receiving tenders on improvements to the sewage disposal plant has been extended to June 8th, on which date tenders close with the engineer, Mr. A. B. Manson.

Tenders for the construction of improvements to the sewage disposal plant will be received by the engineer in charge, A. B. Manson, City Hall. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

St. Catharines, Ont.

The Board of Works has recommended that sidewalks be laid on 14 streets and tarmac pavement 18 ft. wide on Carleton street.

Toronto, Ont.

Tenders will be received by the Board of Control until June 9th, for the construction of sewers on 11 streets, 5 lanes and West Toronto System, Div. No. 1. Plans, etc., are at the office of the commissioner of works.

Tenders close with the Board of Control on June 9th, for the erection of circular brick chimneys, one 160 ft. x 90 in. for the main pumping station, and one 50 ft. x 84 in. for the high level station. Plans are at the office of the Purchasing Dept., Room 12, City Hall.

Vegreville, Alta.

The town council proposes to expend the sum of $75,000 on extensions to the sewer and waterworks systems.

The following improvements have been provided for in the estimates for this year: sidewalks $2,000; street improvements, $1,500; improvements to public parks and buildings, $3,700; general municipal work $25,000.

Winnipeg, Man., Transcona

Tenders will be received by the secretary-treasurer, G. P. Campbell, until noon May 30th, for material and labor for the following: (1) well drilling; (2) water pipe and special castings; (3) hydrants, valves and valve boxes; (4) laying water pipe and appurtenances; (5) sewer pipes; (6) sewer castings; (7) constructing sewers. Plans and specifications are at the office of the engineer, Wm. Scott, 204 Sterling Bank Bldg.

CONTRACTS AWARDED

Camrose, Alta.

The municipal council has awarded to Chas. Gray, Prospect Ave., the contract for trenching for sewers and water mains, installing manholes and erecting hydrants.

Esquimalt, B.C.

The contract for Section "B" of the sewer system has been awarded by the municipal council to Agnew & Young, Victoria, $82,000.

Ford City, Ont.

The contract for the construction of concrete sidewalks on various streets has been awarded by the municipal council to David Todd, of 13 Wyandotte St., Windsor.

London, Ont.

The city council has awarded the following sewer contracts: T. W. Nicholson, of Cleveland, Ohio., Egerton St., $149,160; F. H. Harding, King St., Adelaide St., $27,209; McLaughlin Bros., of Ottawa, Colborne St., $40,497; J. H. McKnight Construction Co., Ltd., of Toronto, Ridout St., $32,654; Macky, Mackay & Webster, of Hamilton, Wharncliffe Road, $23,415.

London South, Ont.

A contract for the asphalt paving of Wortley Road has been awarded by the city council to Foley & Gleason, of Ottawa, at $2.15 per sq. yd.

Quebec, Que.

The city council has awarded to the Canada Iron Corporation, Ltd., of Montreal, a contract for the supply of 630 tons of cast iron pipe, 4-in. at $33; 6-in. at $31; 8-in. at $31; 12-in. at $30; 14-in. at $30, and specials at $63.

Victoria, B.C.

The city council has awarded to Evans, Coleman & Evans, Limited, 613 Pandora Street, the contract for the supply of 10,000 ft. [illegible] in. steel pipe.

Virden, Man.

The Prov. Govt. Highway Commrs. have awarded to Hyland & [illegible], of

Winnipeg, the contract for the construction of 10 miles of road in Wallace Municipality.

Welland, Ont.
A contract for the laying of cement sidewalks on various streets has been secured by Somerville & Reid, at 13¼c per sq. yd.

Windsor, Ont.
The following additional contracts have been awarded by the city council. The supply and installation of service pipes, at 42 cents per ft., Robt. Paddon & Co., 149 Sandwich St. E.; supply corporation cocks, 500 at 74 cents each, Parent Bros., of Tecumseh, Ont.; laying 6-in., 8-in. and 10-in. mains at 25 cents, 27 and 30 cents per ft., Ben. Oldani & Company.

Winnipeg, Man.
The contract for the laying of a sewer on Strathcona St. has been awarded by the board of control to J. W. Astley, Engineer of Construction, Citk Yards.

The following contracts have been let by the board of control: Dominion Construction Co., 290 Selkirk Ave., for sewer in College Street, at $2,223.38; E. F. Campbell, Supt. Asphalt Plant No. 2, City Yards, for sewer in Tinkster Ave., at $2,156.02. J. W. Astley, Engineer of Construction, City Yards, sewer in Prince Street, at $1,826.75.

The following contracts have been awarded by the board of control: E. F. Campbell, Supt. Asph. No. 2 City Yards, watermain in Borebank St., at $260.92; J. W. Astley, Engineer of Construction, City Yards, for watermain in Inkster Ave. at $880; also for construction of pavements on Pembina Highway at $69,329, Broadway at $2,343, Portage at $74,585, Johnson Ave. at $32,838.60, Waterloo at $23,473.35 and three lanes at $6,339.30, Notre Dame at $2,942.40.

Railroads, Bridges and Wharves

Armstrong, B.C.
The city will construct four reinforced concrete highway bridges to the plans of C. R. Yuill, of Vancouver and Vernon, B.C., consulting engineer for the city. Mr. Yuill is carrying on the engineering work formerly conducted by Messrs. Mather, Yuill & Company, of Vancouver.

Calgary, Alta.
The ratepayers have passed the by-law providing for the construction of a concrete bridge over Bow River at Centre St., to cost $375,000; a concrete bridge over Elbow River at 4th St. to cost $77,600; and a steel bridge over Bow River at 9th St. W., to cost $60,000.

Glenelg Twp., Ont.
Tenders will be received by the reeve, Thos. Nichol, Priceville, Ont., until June 5th for the construction of a concrete arch bridge. Plans are at the office of the reeve.

Hay Twp., Ont.
Tenders for the building a number of cement bridges will be received by the township clerk, Fred Hess, Sr., Zurich, Ont., until May 30th.

London, Ont.
The board of control has under consideration the construction of a bridge on Wellington street over the C. P. R. tracks. Part of the cost will be borne by the C. P. Ry. Co.

Mill Cove, N.S.
Tenders for extensions to the breakwater will be received by R. C. Desrochers, Public Works Dept., Ottawa, until 4 p.m., June 22nd. Plans and specifications are at the offices of district engineers, Halifax, N.S.; Antigonish, N.S.; Postmaster, Mill Cove, and at above department, Ottawa. Specifications at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Priceville, Ont.
Tenders will be received by the clerk, W. J. Bellamy, Flesherton, Ont., until 5 p.m. June 10th, for the construction of a concrete, steel, reinforced bridge over Saugeen River. Plans and specifications are at the office of the engineer, Owen Sound, and with Wm. Aldcorn, Priceville.

Ste. Claire, Que.
Plans and specifications for the construction of 2 abutments, pillars, steel superstructure, wharf, etc., are with the secretary-treasurer, Ans. Chabot, who will receive tenders until June 1st.

South Dumfries Twp., Ont.
Tenders will be received by the township council until 6 p.m. May 30th, for the superstructure of a Class "A" steel highway bridge with a 16-ft. roadway and 30-ft. clear waterway on Harrisburg road over Fairchilds Creek, near St. George. Plans and specifications are with Jackson & Co., Engineers, Temple Bldg., Brantford.

Three Rivers, Que.
Plans for an underground conduit system are being prepared by the city council. Engineer, Jas. Bennett, Board of Trade Bldg., Montreal.

Toronto, Ont.
The York Twp. Council has decided to build a concrete bridge across the Don River at Smith's Mills. F. Barber, 57 Adelaide St. E., is the engineer.

Tenders will be received by the board of control until June 16th for steel superstructure (and fabrication and erection) of bridge over G.T.R. tracks at Strachan Avenue.

Yarmouth, N.S.
A petition is being signed and will be forwarded to the government asking for the erection of a lighthouse and fog alarm station on Gannet Rock.

CONTRACTS AWARDED

Ayr, Ont.
The following contracts on the extensions to the bridge, have been awarded by the county authorities. Gencontractors for steel work and concrete floors, The Hamilton Bridge Company, $2,412. General contractor for concrete abutments, etc., J. Pipe, of this town.

North Cayuga Twp., Ont.
The township council has awarded to L. J. Looby, of Dublin, Ont., the contract for the construction of a concrete arch, bridge over Teasdale Creek.

St. Felicien, Que.
The bridge contract has been awarded by the municipal council to Ligori Gagnon.

Public Buildings, Churches, Schools, etc.

Barrie, Ont.
The town council will make an application to the Carnegie Trust Fund for the sum of $15,000, for the erection of a public library.

Beamsville, Ont.
The ratepayers will vote on June 4th on a by-law providing for the purchase of site, erection and equipment of a high school building on King St., at a cost of $20,000.

Carberry, Man.
The Public Works Department has secured a site for the post office, and tenders will be called shortly.

Guelph, Ont.
The Board of Education has decided to erect a new collegiate institute instead of making addition to present building.

Harley Twp., Ont.
Tenders for the erection of a school building are invited by J. McClung, Secretary, School Section No. 4, Thwaits P.O., until June 10th. Plans and specifications are at the office of "The Herald" and with secretary.

Hensall, Ont.
The sum of $5,000 has been voted for the erection of a town hall, fire hall and police station.

Hamilton, Ont.
The proposal to make alterations and additions to the armouries, at a cost of $150,000 has been postponed for a year.

Plans are in hand for certain additions to the R. C. Hospital on John St. S. Stevens & Lee, of 2 College St., Toronto, are the architects.

Inisfill, Ont.
Plans are being drawn for a new church for the Episcopal Church congregation. Philip C. Palin, of Collingwood, is the architect. Estimated cost $10,000.

London, Ont.
Plans for alterations to Princess Ave. School are being prepared by the architects, Watt & Blackwell. The estimated cost is $25,000.

Medicine Hat, Alta.
Plans for a post office and immigration building to cost $50,000, have been drawn by the Public Works Department.

Tenders will be received by the Public School Board until June 8th, for erection of a 10-room addition to the Alexandria School. Plans and specifications are at the office of the architects, McCoy & Levine, Hooper and Huckvale Block.

Midland, Ont.
Tenders for the erection of a public library will be received by the secretary of board, H. J. Craig, until noon May 29th. Plans, etc., are at the Library or the office of the architect, W. A. Mahoney, Telephone Bldg., Guelph.

Montreal West, Que.
Sub tenders for additions to Kensington St. School are invited by the contractors, Reid, McGregor & Reid, Drummond Bldg.

Montreal, Que., Westmount

No contracts have been awarded yet in connection with the proposed Methodist Church on Roslyn and Lansdowne Sts. Nothing is likely to be done this year.

Nanaimo, B.C.

The municipal council has been notified that the sum of $50,000 will be granted by Mr. Andrew Carnegie for the erection of a public library.

As a report has been presented by special committee condemning present jail building, arrangements are being made to purchase a site for a new building.

Newcastle, N.B.

The Miramichi Hospital Board has secured options on several sites, when one is chosen plans will be drawn and work started as soon as possible.

Oshawa, Ont.

Plans have been drawn for the erection of a new church for the St. George's English Church Congregation. H. G. King, of 93 Yonge St., Toronto, is the architect.

Ottawa, Ont.

The erection of a church on 1st and Carling Sts., is proposed by the St. Matthews Parish. Clerk, Geo. Hooper, Elgin St.

Ponoka, Alta.

Tenders for the erection of a dormitory will be received by John Stocks, Dept. of Public Works, Edmonton, until noon, June 1st. Plans and specifications are with the Dept., Calgary, and at the office of the Provincial Architect, Parliament Buildings, Edmonton.

Redcliff, Alta.

The sum of $7,500 has been voted by the council to be spent on additions to the city hall for accommodation of the Fire Dept.

Regina, Sask.

Bishop Mathieu has applied to the city for a site for the erection of a girls' institute. The matter is being considered.

Ste. Croix, Que.

Tenders will be received by the secretary-treasurer, Jos. Bedard, until 10 a.m. June 10th, for the construction of a safety vault for the registry office.

Tavistock, Ont.

The erection of a new church building is being considered by the Lutheran Church Congregation.

Toronto, Ont.

The time for receiving tenders on carpentry work, etc., at Government House has been extended to June 2nd.

The Roman Catholic Denomination have purchased sites Blackthorne and Caledonia Ave., and Roncesvalles Ave., for the erection of new churches.

The Y. W. C. A. Board are considering the establishment of a new branch buildings in the east and west ends of the city.

Tenders for a 4-room addition to Manning Ave. school will be received by J. G. Hall, 24 Duke street, secretary to the Separate School Board, until June 1st, for all trades. Plans are at the office of the architect, C. J. Read, Confederation Life Bldg.

Toronto, Ont. (Fairbank)

Bulk or separate tenders on school additions will be received by the secretary of the Fairbank Public School Board, until June 1st. Plans, etc., at office of the architects, Lindsay, Brydon & Greig, Trinity Sq., Toronto.

Vancouver, B.C.

New tenders are about to be called for the Old Peoples' Home near Boundary Road and Union Street. A contract was awarded last year but the work was not undertaken. Perry & Fowler are the architects.

Walkerville, Ont.

Tenders received for the erection of the proposed hospital were too high. Contractors submitting lowest tenders have been asked to revise their figures. Lankley & Howland, 112 King St. West, Toronto, are the architects.

Welland, Ont.

The ratepayers have defeated a by-law providing for a public library towards the erection of which the Carnegie Fund offered $20,000.

Winnipeg, Man.

The congregation of the Central Congregational Church will meet shortly to consider the details of the proposed new church. J. D. Atcheson & Co. are the architects.

Tenders will be received by the board of control until June 1st for the erection of two comfort stations on Fort Street and Garry Street. Plans and specifications are at the office of the engineer, H. N. Ruttan, 223 James Ave.

CONTRACTS AWARDED

Calgary, Alta.

M. V. Anderson, of 16th Ave., N.W., has secured the general contract for the erection of the Presbyterian Church on Crescent Heights.

Hanna, Alta.

The school contract has been secured by Bennett & Debman, of 52 Thomas Block, Calgary.

Montreal, Que.

The contract for the erection of a school building has been awarded by the Protestant Board of School Commissioners to A. F. Byers & Co., Ltd., 340 University street, who will sublet several trades.

Ottawa, Ont.

The following contracts have been awarded in connection with the Perley Memorial Home. General contractor, T. C. James, 140 Flora St.; carpentry, W. G. Adamson, 126 Sparks St.

Peterboro, Ont.

The following contracts have been awarded on the erection of a church and rectory for the Church of Immaculate Conception. General contractor for basement of church, H. Hickey, 535 Reid St.; general contractor for rectory, T. Rutherford, 625 Union St.

Toronto, Ont.

The contract for St. Francis Roman Catholic Church on Grace St., has been awarded to R. Sheedy, Empress Hotel, Yonge & Gould Sts., who is now open for tenders on excavation.

W. B. Graham and J. A. Berridge having withdrawn their tenders, the following new contracts have been awarded on the Orde Street School. Carpentry, Crocker & LeDrew, 15 Ossington Ave.; fireproofing, Robt. Bennett, Kingston Road, $2,347.50.

The following contract on the additions to Davisville school have been awarded by the Board of Education, Sec.-treas., W. C. Wilkinson: masonry, John McMurren, 319 Roxboro E., $14,149; carpentry, J. A. Berridge, 518 Manning Ave., $8,994; plastering, $1,907; fireproofing, $1,498; painting and glazing, Jas. Phinnemore, 445 Yonge St., $685; roofing and sheet metal, D. M. Rowe & Co., 154 Euclid Ave., $646; iron stairs, Shipway Iron Bell & Wire Mfg. Co., King St. W., $1,857; plumbing, J. R. Seager, 799 College St., $5,185; steam heating and ventilating, Fred Armstrong, Queen St. W., $6,094; heat regulators, Johnston Temperature Reg. Co., Adelaide St. W., $970; wiring, A. R. Rice & Co., 152 Bay street, $577.

The following contracts have been awarded by the Board of Education: Lansdowne School, structural steel, W. D. Beath & Son, 20 Cooper Ave., $69; prism floor lights, J. D. McDonell Co., $350; roofing and tinsmithing, D. W. Rowe Co., 154 Euclid Ave., $442. Pauline Ave. School: ash hoist, W. D. Beath & Son, $160. Duke St. School: plumbing, Bennett & Wright, 72 Queen St. E., $85. Kent St. School: plumbing, Lewis Legrow, 92 Harbord St., $159.

Toronto, Ont., Long Branch

The rifle range contract has been awarded to Sherwood & Sherwood, of Sudbury and Toronto.

Vancouver, B.C.

The Strathcona St. fire hall contract has been secured by Ross & Wiley, 388 Sixth Ave. E.

Business Buildings and Industrial Plants

Antigonish, N.S.

The erection of a skating rink is being considered by the St. Francois Xavier Athletic Association. The necessary funds are to be raised by subscriptions.

Berthier, Que.

Saxe & Archibald, architects, Beaver Hall Hill, Montreal, are receiving tenders on the erection of a distillery for the Melcher Gin Company.

Brampton, Ont.

The town council has under consideration the erection of an abattoir which has been recommended by Dr. Sharpe, the medical officer of health.

Edmonton South, Alta.

Tenders for the erection of "Princess" theatre on Whyte Ave., are invited by the architects, Herrald & Wilson, Credit Foncier Block.

Hamilton, Ont.

Jno. H. Parker Company of Canada, Ltd., 8 Colborne Street, Toronto, and New York City, who have the contract for the Union Hotel, are inviting subtenders.

Lindsay, Ont.

John McCrea, of William St., proposes to make an extension to his foundry.

(Continued on page 86

Tenders and For Sale Department

Bridge Contract

Tenders will be received by the undersigned up to five o'clock p.m. of **June 10th, 1914**, for the erection of a concrete, steel reinforced bridge over Saugeen River in the village of Priceville, according to plans and specifications by R. Mc-[illegible]

Plans, etc., may be seen at the office of the Engineer, Owen Sound, or with Wm. Aldcorn, Esq., Priceville, and at the office of the undersigned at Flesherton.

The lowest or any tender not necessarily accepted.

A marked cheque for six per cent. of tender to accompany each tender.

W. J. BELLAMY,
Clerk, Artimesia Township.

May 19, 1914. 21-22

Notice to Contractors

Time for receiving tenders for the interior finishing of the Main Building of Government House, Rosedale, Toronto, including carpenter and joiner work, plastering, painting and glazing, marble work and bronze work, has been extended until noon of **Tuesday, June the 2nd.**

By order,

H. F. McNAUGHTEN,
Secretary Public Works Department.
Department of Public Works, Ontario.
May 20th, 1914. 21

Sealed tenders addressed to the undersigned, and endorsed "Tender for Drill Hall, Napanee, Ont.," will be received at this office until 4 p.m. on **Friday, June 5, 1914**, for the above mentioned Drill Hall at Napanee, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, Napanee, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, May 13, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—56625.

City of Stratford

Sealed tenders, marked "Tender for Sewage Disposal Works," will be received by the undersigned up to **Monday, June 8th, 1914**, at 5 o'clock p.m., for the construction of Sedimentation Tanks and Grit Chambers for Sewage Disposal Works.

Plans and specifications may be seen at the offices of the Canadian Engineer, The Contract Record or the City Engineer.

Forms for Tender and any necessary information may be had from the office of the City Engineer.

The lowest or any tender not necessarily accepted.

A. B. MANSON,
City Engineer.

21-22

Department of Railways & Canals, Canada

Trent Canal
Section 3, Severn Division

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Section No. 3, Severn Division, Trent Canal," will be received at this office until 12 o'clock noon on Thursday, June 18th, **1914.**

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa; at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.; and at the office of the District Engineer, Public Works Department, Midland, Ont.

Copies of plans and specifications may be obtained from the Department on the payment of the sum of fifty dollars. To bona fide tenderers this amount will be refunded upon the return of the above in good condition.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of $55,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderers will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,

Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 21st May, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—61920. 21-22

Concrete Arched Bridge

Sealed tenders, marked "Tender," and addressed to the Reeve, Township of Glenelg, Priceville, Ont., will be received up to **Friday, June 5th**, for the construction of a concrete arched bridge at lot 32, Con. 2 and 3, N. D. R. Glenelg. Tenders will be opened at the Township Hall, June 6th.

Tenders will be received as follows:—A reinforced concrete arched bridge, 50 feet span, 14 foot roadway. An accepted bank cheque for ten per cent. of contract price, payable to the Treasurer, Township of Glenelg, shall accompany each tender and will be returned on non-acceptance. Council supplies reinforcing.

Plans and specifications may be seen at the office of the Reeve, near Priceville.

The lowest or any tender not necessarily accepted.

THOS. NICHOL, Reeve.

Priceville, May 22, 1914. 21-22

Notice to Contractors

Asphalt Pavements

Sealed tenders addressed to the Chairman and Members of the Board of Control, Ottawa, will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m. **Tuesday, June 9th, 1914**, for the construoticn of approximately 19,200 square yards of asphalt, 2,200 lineal feet of concrete combined curb and gutter and 3,600 feet of concrete gutter.

Any tender received after the above stated time will be declared informal.

Specifications and full particulars may be obtained on application at the City Engineer's office.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.

Ottawa, May 23rd, 1914. 21

CITY OF MOOSE JAW

NOTICE

Sealed tenders marked "Tender for Street Paving," "Manhole Frames and Covers," or "Lead Pipe," addressed to the City Commissioners, Moose Jaw, Saskatchewan, will be received up to 10 a.m. on **Friday, June 5th, 1914**, for the following:—

Contract No. 85, for approximately 19,000 square yards street paving.

Contract No. 86, for 295 Cast Iron Hanhole Frames and Covers and 200 Catchbasin Frames.

Contract No. 87, for 52 tons of ⅝-in. lead pipe, and 5 tons pig lead.

Plans may be seen and specifications and form of tender obtained at the City Engineer's office. A deposit of five dollars will be required for each set of the specifications, which deposit will be returned on receipt of a bona fide tender.

Each tender must be accompanied by a marked cheque payable to the order of the City Treasurer for five (5 p.c.) per cent. of the value of the total cost of each contract.

The Commissioners do not bind themselves to accept the lowest or any tender.

JAMES PASCOE, Mayor,

GEO. D. MACKIE,

W. F. HEAL, City Commissioners.

Dated at Moose Jaw, this 18th day of May, 1914. 20-21

TRANSCONA, MAN.

Water Supply System and Sewerage System

Sealed tenders will be received by the undersigned until twelve o'clock noon, **May 30th, 1914**, for the supply of materials and labor for the above works:

Contract (1) For Well Drilling.
Contract (2) For Water Pipe and Special Castings.
Contract (3) For Hydrants, Valves and Valve Boxes.
Contract (4) For Laying Water Pipe and appurtenances.
Contract (5) For Sewer Pipes.
Contract (6) For Sewer Castings.
Contract (7) For Constructing Sewers.

Plans, specifications, etc., may be had at the office of W. M. Scott, Engineer, 204 Sterling Bank Bldg., Winnipeg.

A deposit (cheque) of $25.00 will be required for each set of plans and specifications for Contracts (4) and (7). This will be returned when plans are returned in good condition at or before the date tenders close.

The lowest or any tender not necessarily accepted.

G. P. CAMPBELL, Sec.-Treasurer,
20-21 Town of Transcona, Man.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, June 9th, 1914**, for the construction of the following [illegible]:

Bowmore Road, Wrenson Road to Gerrard St.
Central Ave., Indian Rd. to Indian Rd. Cres.
Chisholm Ave., Danforth Ave. to north city limits.
Gates Ave., w.s. Chisholm Ave. to Meagher Ave.
Gerrard St., Woodbine Ave. to Morton Road.
Harris Ave., w.s. Chisholm Ave. to Meagher Ave.
Lane first north Danforth Ave., w.s. Pape Ave. to e.s. Carlaw Ave.
Lane first south Queen St., Gwynne Ave. to Elm Grove Ave.
Lane first north Queen St., Triller Ave. to [illegible] Ave.
Lane first west Shaw Street, Harbord Street to lane first south Bloor Street.
Lane first north Wellington St., Peter St. to Spadina Ave.
Meagher Ave., Danforth Ave. to north city limits.
Mercer Street, John St. to Peter St.
New Market Ave., w.s. Chisholm Ave. to Meagher Ave.
West Toronto Sewer System, Division No. 1 Stand-by Tank.
Wrenson Road, Pullen Ave. to Bowmore Rd.
W[illegible] Avenue, Danforth Avenue to north city limits.

Envelopes containing tenders must be plainly marked as to contents.

Specifications may be seen and forms of tenders obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto, or the bond of [illegible] Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by the City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, May 19th, 1914. 21

TENDERS

Bulk and separate tenders will be received by the undersigned, for the several works required in a three-storey fireproof addition 66 x 100 ft. Tenders close **June 3rd, 1914.**

W. E. NOFFKE, Architect,
405 Plaza Building,
21 Ottawa, Ont.

CITY OF KELOWNA, B. C.

Tenders Wanted

Tenders in duplicate for the supply of the following apparatus F.O.B. cars Kelowna, B.C., will be received by G. H. Dunn, City Clerk, up to 12 o'clock noon on **Thursday, June 11th, 1914**:

One—225 B.h.p., Vertical, Two Crank Compound Steam Engine.
One—Feed Water Heater.
One—Independent Air Pump and Jet Condenser.
One—150 Kilowatt, 2300 Volt, Three Phase, 60 cycle, Alternating Current Generator for direct connection to engine.
One—Exciter for direct connection to Generator.
One—Switchboard Panel to match present switchboard.

Deposit cheque of 5 per cent. required.

The lowest or any tender not necessarily accepted.

Specifications may be seen after May 25th, 1914, at the following offices:

Canadian Engineer, Montreal.
Canadian Engineer, Winnipeg.
Electrical News, Toronto.
Electrical News, Vancouver.

or may be obtained from the Consulting Engineer's Branch Office at Vernon, B.C.

C. R. YUILL,
Successor to
Mather, Yuill & Company, Limited,
20-22 Consulting Engineer.

TOWN OF WALKERVILLE

Tenders for Paving and Sewer

Sealed tenders will be received by registered post addressed to the undersigned up to noon on **Monday, the 8th day of June, A.D., 1914**, for paving and the construction of a sewer in the Town of Walkerville as follows:

Reinforced concrete pavement on Ontario St. from Windermere Road to the westerly limits.

Reinforced concrete pavement on Lincoln Rd. from Erie Street to the southerly line of Lots 412 and 417.

Reinforced concrete pavement on Ottawa St. from Windermere Road to the westerly limits.

Reinforced concrete pavement in alley between Kildare and Devonshire Roads from Tuscarora to Cataraqui streets.

Reinforced concrete pavement in alley between Kildare and Victoria Roads from north side of Niagara Street to Brant Street.

Sewer on Lincoln Road from southerly line of Lots 412 and 417 to Tecumseh Road.

Plans and specifications may be seen on application to Owen McKay, C.E., Walkerville, [illegible].

Tenders must be accompanied by a marked cheque payable to the Town Treasurer equal to [illegible].

Should any party whose tender is accepted fail to execute the necessary contract and bond for the due fulfilment of the same his deposit will be forfeited to the Town.

Deposits of unsuccessful tenderers will be returned.

The lowest or any tender not necessarily accepted. The names of two responsible persons [illegible] must accompany tender.

CECIL H. ROBINSON,
21 Town Clerk.

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, June 9th, 1914**, for the construction of a concrete beam bridge over a branch of the Holland River on the Townline between the Counties of York and Simcoe, north of Schomberg, known as Brown's Bridge.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Bridge Engineer.
Toronto, May 20, 1914.

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned and by J. E. Farewell, Esq., Clerk of Ontario County, Whitby, Ont., up to noon of **Wednesday, June 3rd, 1914**, for the construction of concrete abutments for two 40-ft. steel bridges between the Counties of York and Ontario.

Plans and Specifications and all information may be obtained at the office of J. E. Farewell, Esq., Whitby, Ont., Clerk of Ontario County, and at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Bridge Engineer.
Toronto, May 19, 1914. 21

Tenders for the Fabrication and Erection of the Steel Superstructure of the Strachan Avenue Bridge over the G.T.R. Tracks

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, June 16th, 1914**, as follows:

For the fabrication and erection of the steel superstructure of the Strachan Avenue Bridge over the G. T. R. tracks.

Specification and tender form may be obtained upon application at the office of the Railway and Bridge Section, Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal. Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
May [illegible], 1914. 21

Tenders for Steelwork

Sealed tenders addressed to J. B. Cote, Secretary, [illegible] "Tenders for Provencher Bridge," will be received up to 12 o'clock noon, Saturday, the 20th day of June, for supply and [illegible] of the superstructure to the Provencher [illegible] Bridge over the Red River between St. Boniface and Winnipeg.

Plans and specifications may be seen and forms of tender obtained at the offices of:—

The City Engineer, St. Boniface, Man.
The City Engineer, Winnipeg, Man.
[illegible], Toronto, Ont.
[illegible] Engineer, Montreal, Que.
Pittsburg Testing Laboratories, Pittsburg.
Engineering News, New York.
Strauss Bascule Bridge Co., Chicago.

All tenders to be accompanied by a marked [illegible] bond for $10,000.

The lowest or any tender not necessarily accepted.

J. B. COTE, Secretary,
19-23 City Hall, St. Boniface, Man.

Township of South Dumfries

30 Foot Highway Bridge

Sealed tenders clearly endorsed on the outside "Tender for Superstructure," will be received by the Township of South Dumfries up to 6 p.m. on **Saturday, the 30th of May, 1914**, for the manufacture and erection of a Class "A" steel highway bridge with 16-foot roadway and 30-foot clear waterway on the Harrisburg Road over the North Branch of Fairchild's Creek about one-quarter mile southeast from the G. T. R. Station of St. George.

Specifications may be had from Jackson & Company, Temple Building, Brantford.

Tenders should be addressed to the Township Clerk, H. Maus, Esq., Paris. The Council does not bind itself to accept the lowest or any tender.

ALAN MAIR JACKSON,
20-21 Township Engineer.

For Sale—Cheap

1 Pony Planer, McGregor & Gourley, 24-in., in good running condition.

1 Iron Saw Table, 3 ft. x 5 ft., Ballantyne Tilting Guide.

Box 27, Contract Record & Engineering Review, Toronto. 21-23

Sales Agents

Large United States firm manufacturing concrete chutes, screens, car movers and other engineering and contracting specialties wants representatives in Canada. Write advising what section you can cover, to Box 22, Contract Record & Engineering Review, Toronto. 19-21

Business Buildings and Industrial Plants

(Continued from page 83)

London, Ont.

Plans are being drawn for alterations to the Imperial Bank building, King and Richmond Sts. McBride & Gilbert are the architects.

Montreal, Que.

Plans for additions to the bakery of Jas. Strachan, 246 City Hall Ave., have been drawn by Sydney Comber, Green Ave. and St. Catherine W.

It is understood that the factory of the Aetna Biscuit Company will not be built this year.

C. E. Deakin, Ltd., 41 Major St., who has the contract for the St. Lawrence St. branch of the Bank of Montreal, is taking tenders on all trades.

Montreal, Que., St. Lambert

The harness factory proposed by G. W. Bithell, 73 St. Lawrence Blvd., Montreal, will not be built this year.

Montreal, Que., Verdun

Plans are being drawn for a factory for Lonsdale & Bartholomew, Ltd., by Peden & McLaren, 20 St. Alexis St., who will shortly call for tenders.

Ottawa, Ont.

Tenders, bulk and separate, on addition to the premises of Chas. Ogilvy, Ltd., Rideau and Nicholas, are invited by the architect, W. E. Noffke, Blackburn Bld., Sussex and Rideau streets, until June 3rd.

Sandwich, Ont.

Alterations and additions to the Essex County Golf Club are proposed. Architect, J. C. Pennington, LaBelle Bldg., Windsor.

Saskatoon, Sask.

As the tenders received on the Saskatchewan Cold Storage Co.'s plant were unsatisfactory, the architects, Thompson & Crockart, Masonic Temple, are inviting new tenders.

Toronto, Ont.

Tenders on the erection of a stable and paint shop on Hyden St., are invited by the architect, Neil G. Beggs, Cosgrave Bldg.

Plans for the erection of a dancing hall and apartments on Dovercourt Rd., have been drawn for C. F. Davis, 215 Dundas St.

The Pacy Aeroplane Company, of Belleville, have purchased a site on the Kingsdale sub-division and intend to erect a 2-storey brick building.

Weyburn, Sask.

Plans for a skating and curling rink are being drawn for the Weyburn Arena Club, Ltd., by Geo. J. G. Jarrett, Fox Block. The estimated cost is $35,000.

CONTRACTS AWARDED

Bridgeburg, Ont.

The contract for the erection of the Tuttle & Bailey Mfg. Co.'s factory, has been secured by the Turner Constr. Company, of New York City.

Calgary, Alta.

The contract for the addition of a hall over the premises of Patrick J. McCrohan, 17th Ave. W., has been secured by R. White, Box 48.

Galt, Ont.

The following contracts have been awarded on the erection of stores, offices and lodge room on Water street north, for I. K. Martin: brick work, Chas. Watson, Dayton St.; carpentry, Peter Nichol, Market St.; other trades are not to let.

Hamilton, Ont.

The contract for masonry on the erection of the branch office for Molsons Bank, has been let to W. H. Cooper, 67 York St.

Montreal, Que.

The contract for renovating St. James Club, Dorchester and University streets, has been secured by Robertson Bros., Chestnut Ave., Westmount.

The following sub contracts have been let in connection with the additions to the Toilet Laundry Company, 425 Richmond St. Steel, Toronto Structural Steel Company, of Toronto; steel sashes, Steel & Radiation, Ltd., 138 Craig W. Contracts on other trades will be awarded shortly.

Montreal, Que. (Outremont)

Plans for the erection of an $8,000 residence are being drawn for J. A. Brisebois, 706 St. Catherine E.

Plans for the erection of residences for J. C. Lamothe and H. E. Trudeau are being drawn by G. A. Monette, Room 706 83 Craig St. W., Montreal.

Montreal, Que. (Westmount)

Plans for a $15,000 residence on Avenue Road for C. N. Robertson, are being drawn by Hutchison, Wood & Miller, who will shortly call for tenders.

Ottawa, Ont.

Tenders on the erection of a double residence on Fairbairn Street are invited by Mr. Spratt, of the Oakland Land Co., Sunnyside.

Toronto, Ont.

S. Leonard, 950 King St. W., has purchased a site on High Park Boulevard and proposes to erect a residence thereon.

Residences

Hudson, Que.

Plans are being drawn for a residence for C. T. McCall, by Hutchison, Wood & Miller, of Montreal, who will call for tenders shortly.

Le Pas, Man.

Dr. Wm. Sinclair has secured a site on Edwards Ave., and intends erecting a 3-storey apartment block thereon.

Montreal, Que., West Crescent Heights

Sub tenders on the erection of the residence of W. de M. Marler, are invited by the general contractors, Reid, McGregor & Reid, Drummond Bldg.

Ottawa, Ont.

W. H. Craig, of 174 4th Ave., proposes to erect 2 residences on Percy St., at a cost of $10,000.

Regina, Sask.

A permit for the erection of an apartment block on Robinson and 14th Sts., at a cost of $61,000, has been issued to the Beta Apartment Co. General contractors, Smith Bros. & Wilson, Hamilton St.

H. Spiesz, 2137 Cameron St., has been granted a permit for the erection of a $5,000 residence on Elphinstone St.

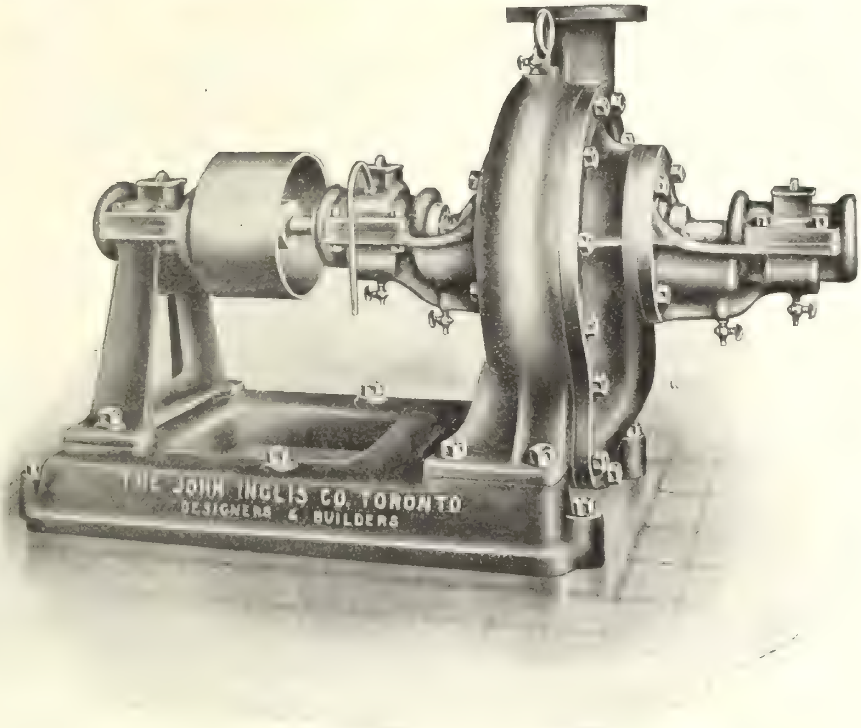
Saskatoon, Sask.

Plans for an $80,000 apartment block have been drawn for Miss Priscilla Ayers, 108 4th Ave. N., by Bugenhagen & Turnbull, 118 Willoughby Sumner Block.

Toronto, Ont.

A permit for the erection of a detached residence on Heath St. W., at a cost of $7,000, has been granted to P. W.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

[illegible]man, 167 Robert St., who will sublet some trades.

Plans for the erection of a detached residence on Palmerston Ave., have been drawn for S. J. Gee, 432 Grace St., who will supervise erection.

Plans for the erection of a detached residence on Whitney Ave., have been drawn for F. J. Russell, 72 Rowanwood Ave. Estimated cost $8,700.

The erection of 50 residences is contemplated by Wilkins & Co., 132 Walmer Rd., who will buy material and supervise construction.

A permit for the erection of a detached residence on Indian Grove, at a cost of $5,800, has been granted to F. Rogers, 1193 Queen St. W., who will sublet plastering, painting, heating, plumbing and electrical.

Plans for the erection of a $6,000 residence have been drawn for M. E. Horwood, 228 Delaware Ave.

Winnipeg, Man.

Recent permits include: S. Benjaminson, 698 Banning St., for a $5,000 residence; C. G. Perry, 14 Fairbairn Block, for a $5,000 residence; A. Diamond, 186 Manitoba Ave., for $30,000 apartment block.

Plans for the erection of a $40,000 apartment block on Victor St., have been drawn by S. Boynjolfson & Co., Builders' Exchange.

Separate tenders on the erection of an apartment block on Corydon Ave., are invited by the architects, Hooper & Davis, Notre Dame Inv. Bldg.

M. Blankstein, 450 Dufferin Ave., has drawn plans for a $20,000 apartment block on Manitoba Ave., for B. Cohen.

Plans for the erection of a 3-storey apartment block, on Toronto St., for M. Malitosky, have been drawn by D. Abramovitch, 5th Floor, McIntyre Blk. Estimated cost $40,000.

Dr. Colchman has had plans drawn for the erection of a $15,000 apartment block on Selkirk Ave. H. Salzman, 186 Manitoba Ave., is the architect.

CONTRACTS AWARDED

Halifax, N.S.

The contract for the erection of a residence on Coburg Road for T. H. Johnson, has been let to Maxner & Dunlop, 152 Windsor street.

Montreal, Que.

The foundation and brickwork on the erection of a residence for Mrs. Chas. M. Hayes, has been secured by J. H. Hutchison, 64 St. Ambroise, St. Henry.

The contract for addition to the residence of Ben Tooke, Braeside Place, has been let to W. M. Irving, Guy Block.

Montreal, Que., Westmount

The contract for the erection of a residence on Carleton Ave., for Miss Elliot, has been secured by W. M. Irving, Guy Block, Montreal.

Montreal, Que. (Westmount)

The following contracts have been awarded on the erection of Mr. W. C. Mowat's residence on Carleton Avenue. General contract, masonry and carpentry, W. M. Irving, Guy Block; roofing, Geo. W. Reed & Co., Ltd., 37 St. Antoine St.; plastering, MacIntyre Plastering Co., 55 Latour St.; painting, Alex. Craig, 41 Jurors Street; heating and plumbing, Selkirk Bros., 2308 Waverley St.; electrical, MacDonald & Wilson, Drummond Street.

Regina, Sask. (Lakeview)

The following contracts have been let on the erection of Mr. R. H. Read's residence on Albert Street and 21st Ave. General contractor, J. G. Traub, 2105 Rae St., Regina; heating and plumbing, Regina Plumbing & Heating Co., Ltd., Hamilton St., Regina.

Winnipeg, Man.

The contract for the erection of a residence for the medical superintendent at Fort Rouge has been let by the board of control to Fraser & McDonald, 512 Gertrude.

Power Plants, Electricity and Telephones

Barrie, Ont.

The Women's Aid of the Royal Victoria Hospital will canvass the town June 3rd to raise money for purchase of an electric elevator. J. F. Jackson, Worsley St., is interested in the scheme.

Colonsay, Sask.

Sec.-Treas. J. Barnes, P.O. Box 35, of the Colonsay Rural Telephone Co., Ltd., will receive tenders for material and construction of a telephone system.

Dutton, Ont.

The installation of a hydro-electric system is being considered by the town council.

Kelowna, B.C.

Tenders will be received by the clerk, G. H. Dunn, until noon June 11th, for one 225 B.h.p. vertical, two-crank compound steam engine; one feed water heater; one independent air pump and jet condenser; one 150 kilowatt, 2,300 volt, three-phase, 60-cycle alternating current generator for direct connection to engine; one exciter for direct connection to generator; one switchboard panel to match present switchboard. Prices delivered Kelowna. Specifications are at the offices of Hugh C. MacLean, Ltd., Vancouver, and 220 King St. W., Toronto, and with C. R. Yuill, the consulting engineer, Vernon.

London, Ont.

The Key Stone Mattress Co., 434 Richmond St., propose to purchase one 15 h.p., one 5 h.p. and one 1 h.p. motors of 550 volt, 3 phase, 25 cycle.

Pembroke, Ont.

The ratepayers have carried a by-law granting to the Elec. Manufacturing Co. of Canada, a bonus of $5,000 a loan, and $50,000 fixed assessments.

Peterboro, Ont.

Tenders will be received by the Canadian General Electric Co., for masonry and brick, carpentry, roofing and galvanized iron, painting and glazing required in the erection and completion of an addition to the sub-station.

Prince Albert, Sask.

The question of the construction of a street railway system is again before the council. The draft agreement submitted has been considered, and a further agreement will be submitted to the council shortly for approval.

Rouleau, Sask.

Tenders are invited by E. E. Johnston, secretary to the Crescent Rural Telephone Co., Ltd., for the supply of material and construction of a telephone system. Plans and specifications are at the Dept. of Telephones, Regina.

Stratford, Ont.

The by-law providing for the installation of an ornamental street lighting system, at a cost of $21,173, on Ontario and Downie Sts., has been passed. Tenders will likely be called shortly as most of the work is to be completed by August.

Strathroy, Ont.

The town council proposes to extend the street lighting system.

St. Norbert, Man.

Plans have been approved for the extension of the Winnipeg Electric Railway line from lot 83, St. Norbert, past St. Norbert Station.

Three Rivers, Que.

Plans are being prepared by the city council for arc street lights on ornamental iron standards.

Toronto, Ont.

Plans for the erection and equipment of a power house on Bain and Logan Aves., have been drawn for the Toronto Housing Co.

Plans for the erection of a terminal station at Yonge St. and Farnham Ave. have been drawn by the Toronto & York Radial Railway.

Vegreville, Alta.

The sum of $25,000 will be spent for improvements to the municipal electric lighting plant.

Watrous, Sask.

Tenders are invited by the Little Manitou Rural Telephone Company until June 1st for the supply of material and labor.

Weyburn, Sask.

Tenders will be called shortly by the city council for the construction of engine and generator for electric lighting plant and erection of a steel smoke stack.

CONTRACTS AWARDED

Duncans, B.C.

The power house contract has been awarded by the municipal council to Robt. McLay, $3,550.

Gravenhurst, Ont.

The sub-station contract has been let by the town council to Etler & Clift, Gravenhurst. The water commissioners will furnish all material.

Kindersley, Sask.

The contract for the installation of a telephone system has been awarded by the South Valley Telephone Company, Limited, to the Kindersley Construction Company.

Miscellaneous

McGregor, Ont.

It is proposed to install a steam heating system in the R. C. Church.

Port Alma, Ont.

The construction of a natural gas purifier, is contemplated by the Southern Ontario Gas Co. Estimated cost $200,000.

SUN-TEX

Clay Products

are as proof against the elements as

The Pyramids of Egypt

C. J. Read,
Architect.

Shea's Hippodrome
Toronto

Fred Holmes and Sons, Limited,
Contractors.

Sun-Tex gray stock brick were used to face the side wall and back of Shea's Hippodrome.

Sun-Tex Brick were also selected for a large percentage of the interior work.

Sun-Tex Clay Products are uniform in size, color and texture, and possess unequalled wearing powers.

The One Price Company

SUN BRICK COMPANY, LIMITED

Traders Bank Building - - - - TORONTO

Strathroy, Ont.
The town council propose to purchase a steel sprinkler capacity 600 gallons, and several fire hydrants.

Tilbury, Ont.
Natural gas mains will be laid by the Southern Ontario Gas Co. to West Lorne, Rodney and surrounding territory.

Tillsonburg, Ont.
The purchase of a fire equipment is being considered by the town council.

Yarmouth, N.S.
The Town Clerk has been authorized to purchase 600 ft. cotton covered fire hose.

CONTRACTS AWARDED

Winnipeg, Man.
A contract has been awarded by the Board of Control to Winnipeg Supply & Fuel Co., Ltd., 300 Rietta, for the supply of [illegible] bbls. of cement delivered to cars Ross Ave., at 68 5-7 per 100 lbs.

Business Notes

Haileybury, Ont.
The office building of E. C. Wright has been partly destroyed by fire.

High River, Alta.
The premises of Fred Pepper, Alberta Garage, has been destroyed together with 10 motors.

London, Ont.
The office building of the Dom. Savings Co. has been completely destroyed by fire. The loss is estimated at $200,000.

Oxford, N.S.
Dr. J. R. Gilroy's stores have been destroyed by fire. The loss, which is placed at $10,000, was partially covered by insurance.

Tara, Ont.
A recent fire resulted in the destruction of several stores and residences. The principal sufferer was Mr. C. R. Tobey, whose loss is placed at $12,000.

Telkwa, B.C.
A serious fire occurred here resulting in the destruction of the McDonell Hotel. Dr. Wallace's residence, and several stores. Loss $50,000.

The plant of the Alberta Lumber Co. has been destroyed by fire. The loss is estimated at $150,000.

New Companies

Davies and Newton, Limited, has been incorporated with a capital of $40,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are A. H. Cox, W. E. Harries, A. V. Hall, F. W. Cox and R. G. Roberts, all of Toronto.

The Alberta Co-operative Building and Land Company, Limited, has been incorporated with a capital of $20,000, with read office at Edmonton, Alta.

Western Pressed Brick, Limited, has been incorporated with a capital of $25,000, with head office at Edmonton, Alta.

The St. Thomas Electrical Company, Limited, has been incorporated with a capital of $40,000, with head office at St. Thomas, Ont. The provisional directors are F. A. Youmans, B. W. Whitworth, J. T. Webster, and W. K. Cameron, ail of St. Thomas, Ont.

The Canada Chain Company, Limited, has been incorporated with a capital of $40,000, with head office at Sarnia, Ont. The provisional directors are R. V. Le Sueur, A. I. McKinley and N. L. Le Sueur, all of Sarnia, Ont.

The Ford-Smith Company, Limited, has been incorporated with a capital of $100,000, with head office at Hamilton, Ont. The provisional directors are P. Ford-Smith and S. W. C. Scott, both of Hamilton, Ont.

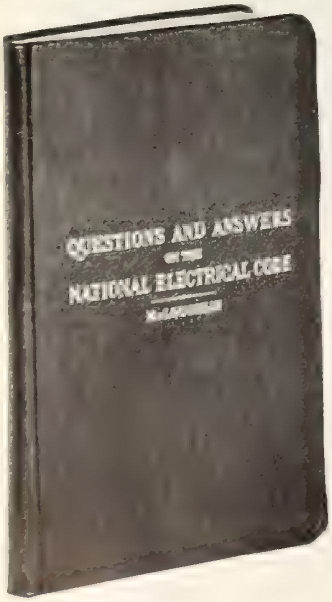
Canada Lock Company, Limited, has been incorporated with a capital of $60,000, with head office at Hamilton, Ont. The provisional directors are W. Morrison, G. W. Ballard, and H. Carpenter, all of Hamilton, Ont.

Standard Welding Company, Limited, has been incorporated with a capital of $3,000, with head office at Hamilton, Ont. The provisional directors are W. Morrison, G. W. Ballard and H. Carpenter, all of Hamilton, Ont.

Arthur L. Weeks
Architect
Canada Life Building, Ottawa
Reinforced concrete and steel structures, factories and commercial buildings

You Can Interpret the Code Instantly with McLoughlin's

Questions and Answers
on the
National Electrical Code



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Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
Every question is carefully indexed so that you can locate the fact you are after instantly.
Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.
Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.
The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding $1.00 net, prepaid.

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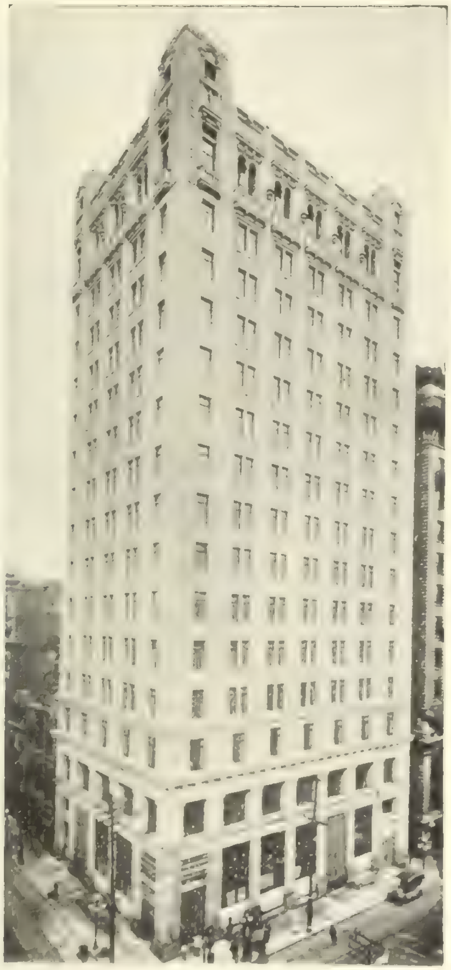
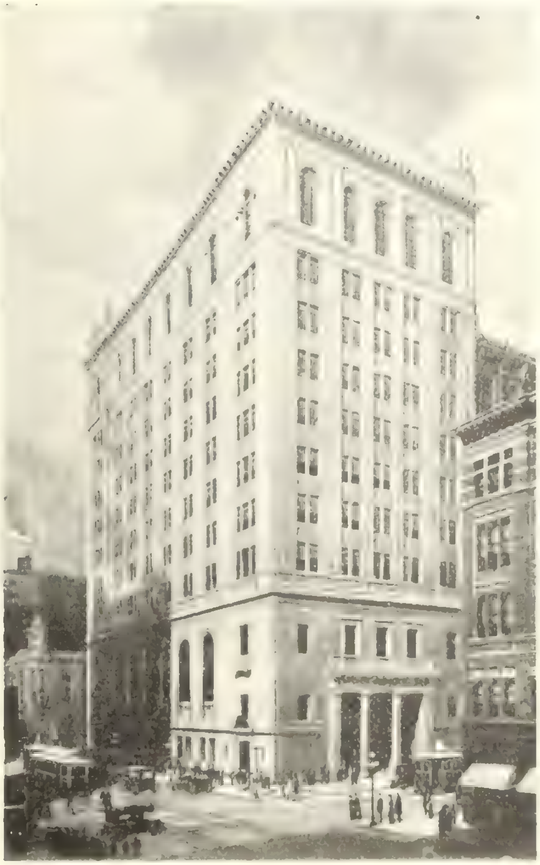
THE NORTHWESTERN TERRA COTTA COMPANY



C. P. R. OFFICE BUILDING
Darling & Pierson, Architects



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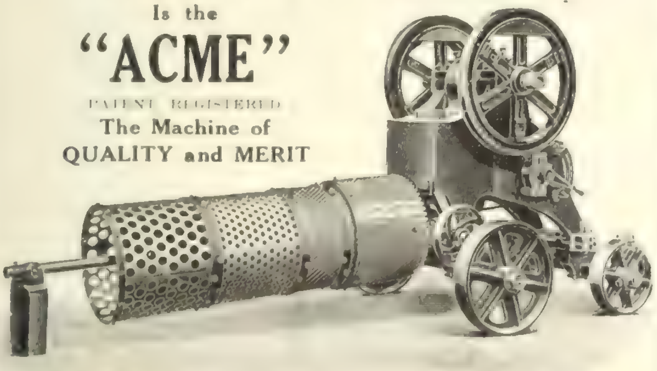

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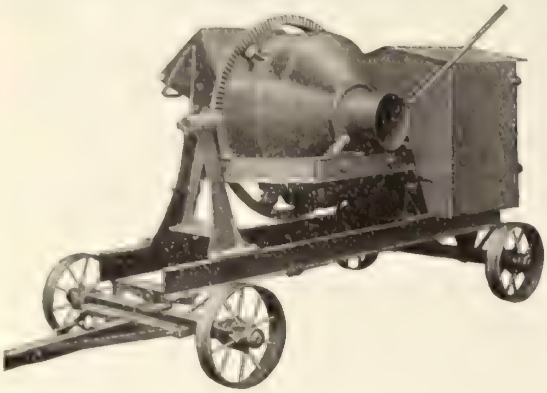

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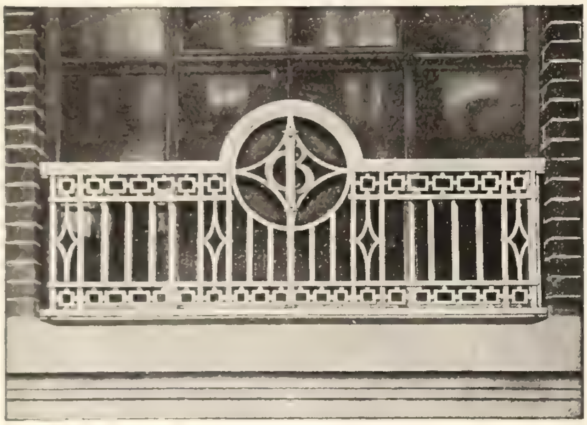

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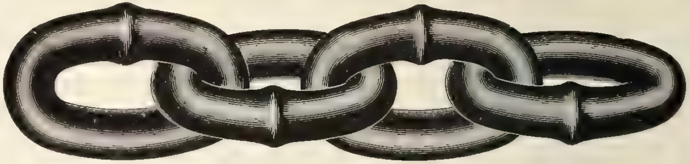

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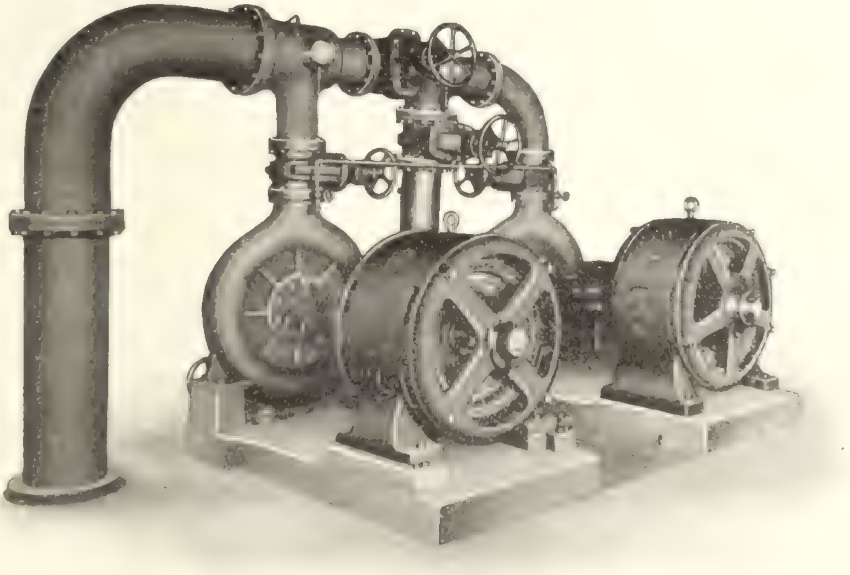

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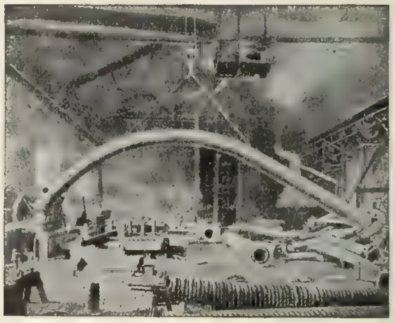

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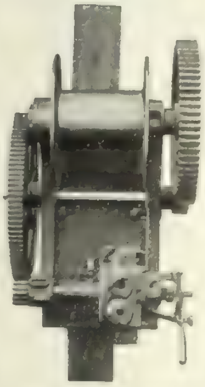

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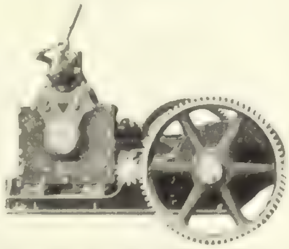

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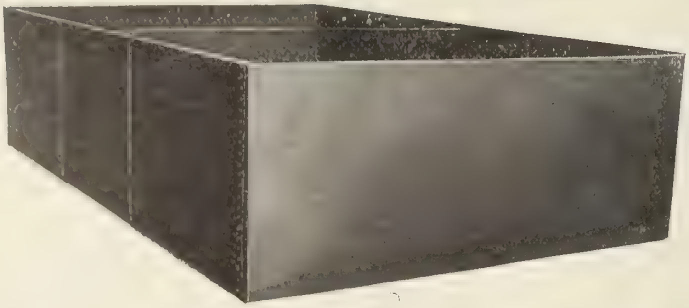

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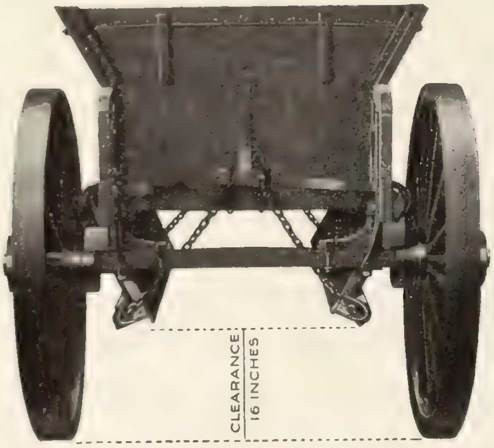

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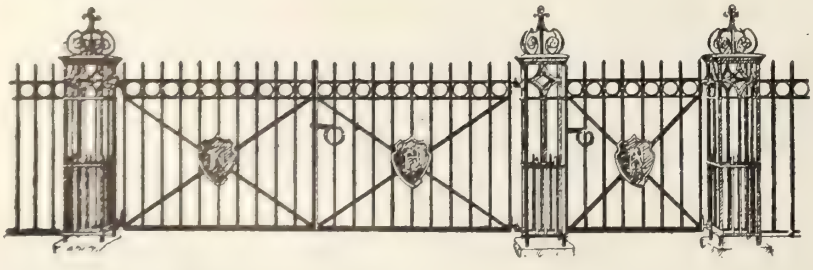

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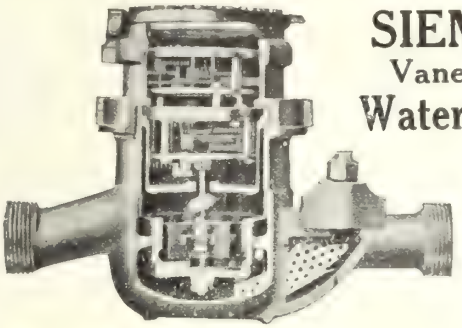

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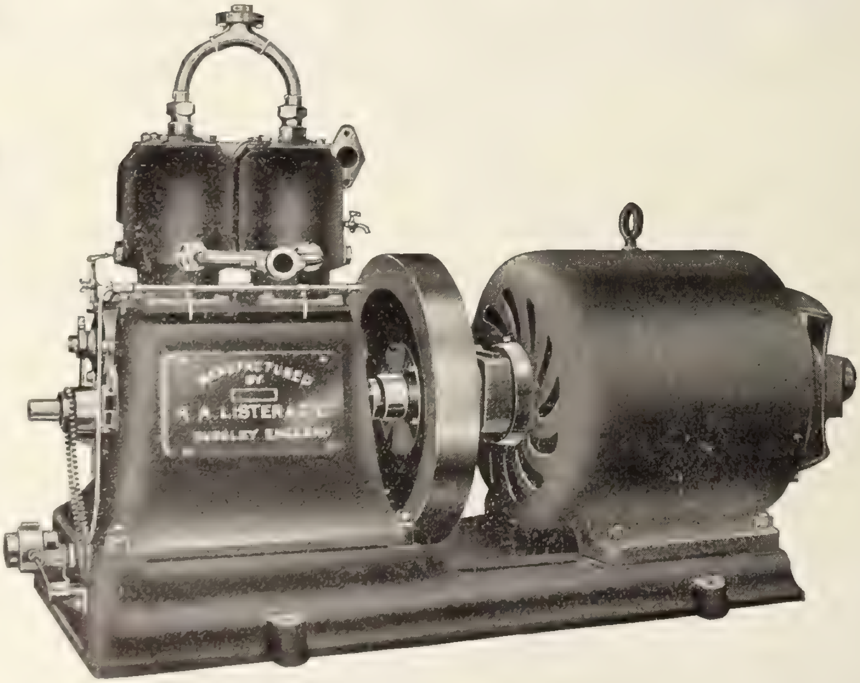

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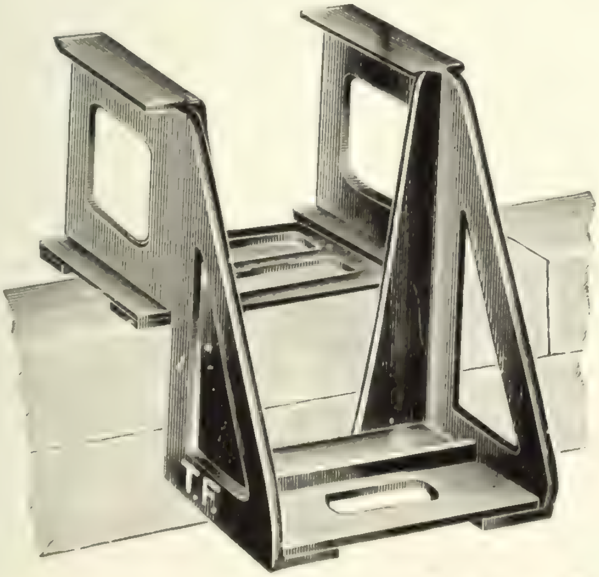

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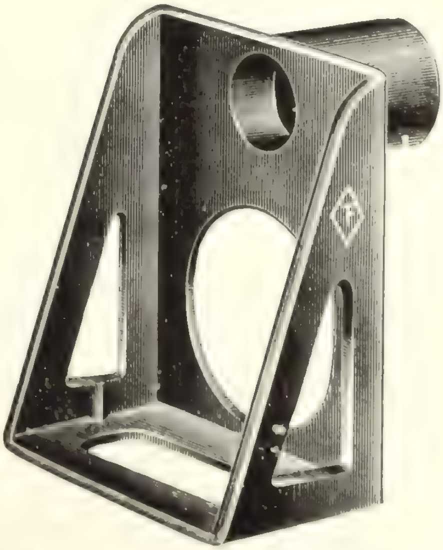

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Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 65c.

MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.35 to $1.50 per bbl., f.o.b. cars, bags 10c; $1.80 l.c.l., bags extra.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—$1 per ton, car loads, on cars.

Gravel—$1.35, f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. Copper bearing sheets—flat, Apollo keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$10.50 per ton. Plaster of Paris—$2.35 per bbl. Rope—British Manilla, 15c basis per pound; second grade, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 67c per gal. of 9 lbs. Raw linseed oil—in barrels, 64c per gal.

WINNIPEG, MAN.

While business in the building and allied industries in Winnipeg could not, at the present time, be considered as unusually active, there is a very fair volume of work in course of construction, and the demand for building materials is fairly strong. This is particularly true of brick, for which, at time of writing, there is quite a brisk call. A good proportion of constructional work in the vicinity of the city, which includes a considerable number of apartment blocks, is being done in brick, and this has tended to a more active movement in clay products. The local plants which cater to this trade report that they are working to capacity. Lumber is moving fairly freely, though less so than was anticipated. Other materials of construction are, to some extent, ousting timber products in Winnipeg district. The increasing use of brick, concrete and other fireproof materials for building is being felt by local lumber concerns. Structural steel, reinforcing bars and similar materials, are only in fair request. There is a moderate call for cement, crushed stone and gravel, and paints and oils are moving freely. On the whole the situation, from the point of view of the supply houses, is satisfactory without being phenomenally active.

Winnipeg Prices

LUMBER (BUILDING MATERIALS)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

(Continued on page 106)

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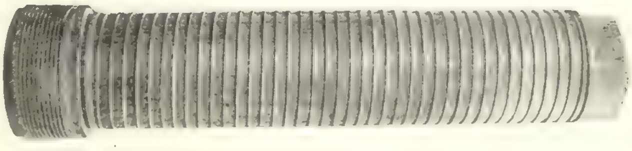

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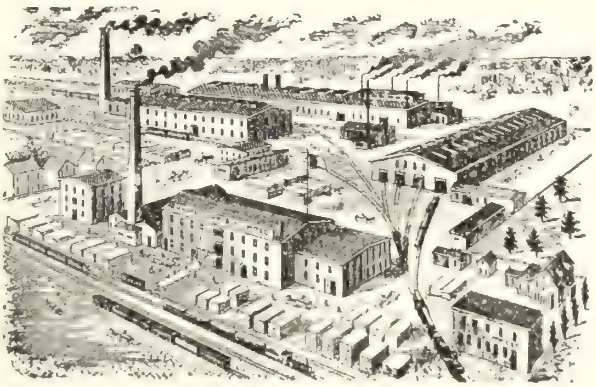

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Fire [illegible] 10-in., $105, 12-in., $110 [illegible] casting, $[illegible] per [illegible] Steel, [illegible] pure [illegible], $6, [illegible] window stool, $[illegible]

Sundries—No. 1 [illegible], $4; No. 2, $3.50, No. 1 [illegible], $5.50, hand [illegible] $7

CEMENT, LIME AND BRICK

Cement—[illegible] lots, $2.60, in car [illegible] $2.[illegible]

Lime—[illegible] per barrel, white, 32 cents, [illegible] per barrel on lots not less than 1,500 lbs.

Brick—No. 1 [illegible] pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colours [illegible] $110, sandlime, $12

Crushed Stone 2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.80 per cu. yd.

Gravel—Per yd., delivered, $1.90.

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

Paints and Oils—White lead, ground in oil, $8.80 per 100 lbs.; boiled liseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.80 per bbl.; putty in 25-lb. tins, $3.20; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse, Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 [illegible]

CRUSHED STONE SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.25; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SUNDRIES AND SPECIALTIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 80c per gal. of 9 lbs.

Raw linseed oil in bbls. 78c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

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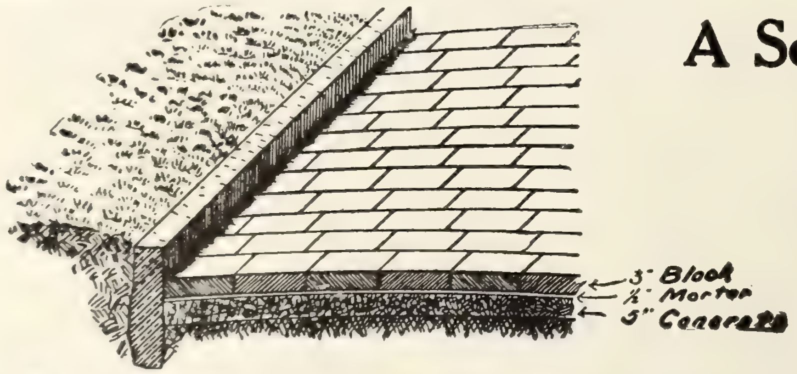

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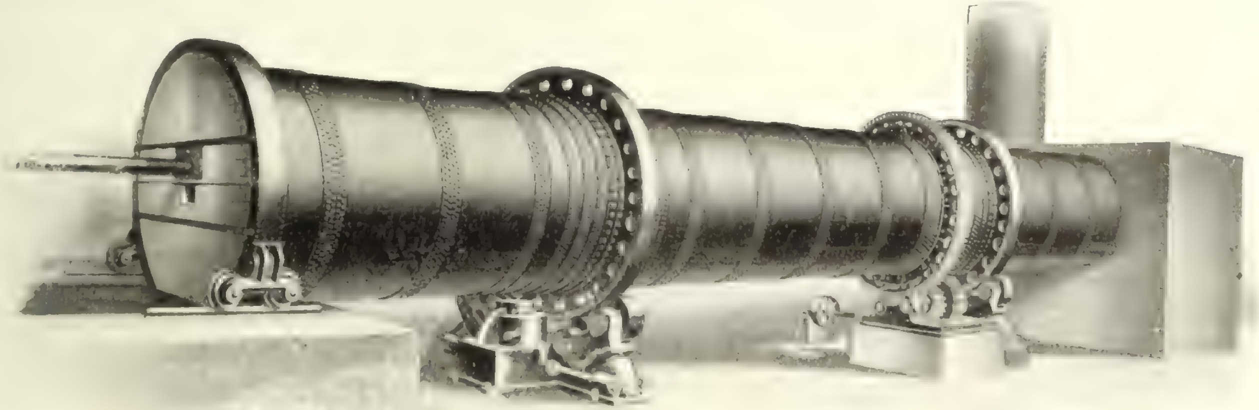

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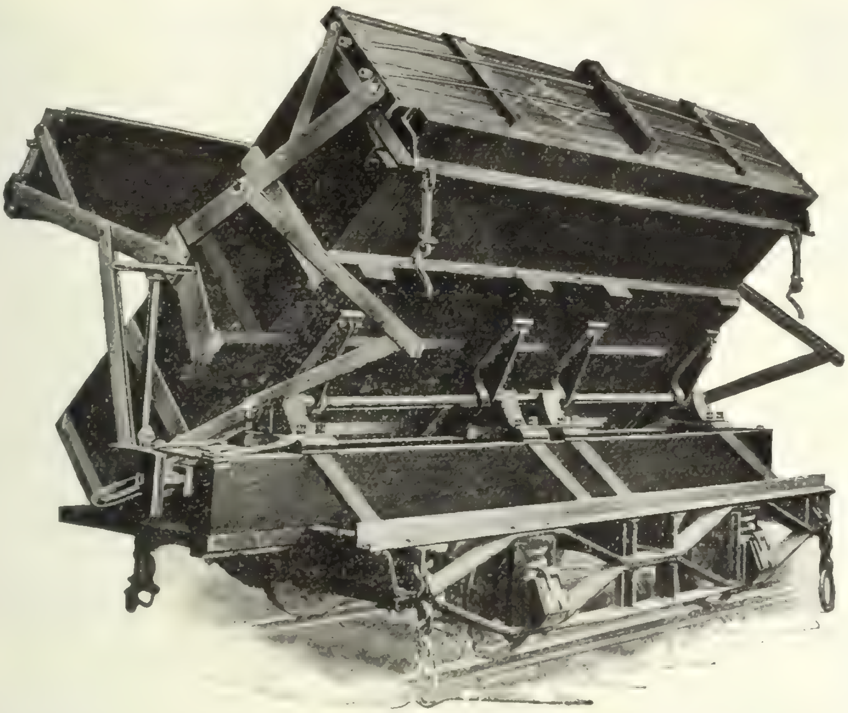

Cut showing 4 and 6 yard Double Diamond Steel Frame Car in dumped position. Full 45 degrees. Door opens away from load.

Last week we began this series showing why our cars deserve your attention and enquiry. Look it up. Keep posted. WRITE NOW.

GLENGARRY

You Want a Steel Frame Car to Have Long Life

This new steel frame car will not disappoint. It is built for hard use and lots of it. STUDY THE CONSTRUCTION. Note the under frame support of box. This box cannot sag down. See the bracing of box ends and doors! The drawbars are bolted clear through to "I" beam girts. The diamond frame is the stiffest possible. Note angle on top instead of flat iron bar. The bracing and trussing of these cars is excellent. Arch braces are trussed across drawbars distributing load on trucks in proper form. You could not build a better car!

Watch next week's issue!

The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

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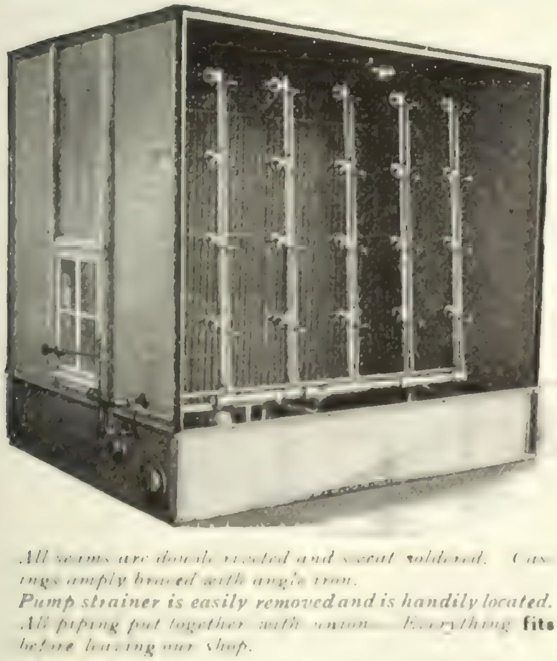

All seams are double riveted and sweat soldered. Castings amply braced with angle iron.
Pump strainer is easily removed and is handily located.
All piping put together with union. Everything **fits** *before leaving our shop.*

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Purifiers, Coolers and Humidifiers

MADE IN CANADA

Embody the very latest improvements in air conditioning apparatus. All spray heads can be flushed simultaneously—**without reducing the efficiency of the spray**—by simply manipulating a three-way cock located on the outside of the machine—all heads are adjustable as to density of spray.

For thoroughly purifying and cleansing the air, a set of scrubber plates are placed **between the** spray heads and the eliminators. They are so arranged that both sides are continuously flooded with water—hence—maximum cleansing surface with minimum resistance.

Write for Bulletin No. 2301 illustrating and fully describing Sirocco Purifiers, Coolers and Humidifiers.

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Special Features

- Centrally situated
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- One block from four car lines
- Floor area, 6,300 sq. feet, each floor.
- Building ready for occupancy June 15th.

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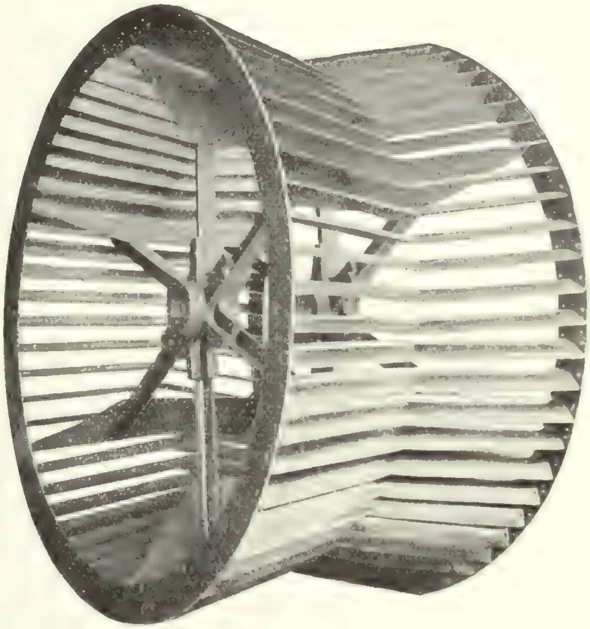
(REG. CAN. PAT. OFF.)

Union "V" Fan



A Fan of exceptionally high efficiency, with large inlet and blade area, and scientifically designed blades and casing.

Every part carefully and rigidly constructed of the best materials obtainable and by a high grade of workmanship.

A Fan that will give continuous satisfactory service at a minimum power consumption.

Built in Canada by the

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For Railway and Bridge Work, Contractors' and Builders' Use

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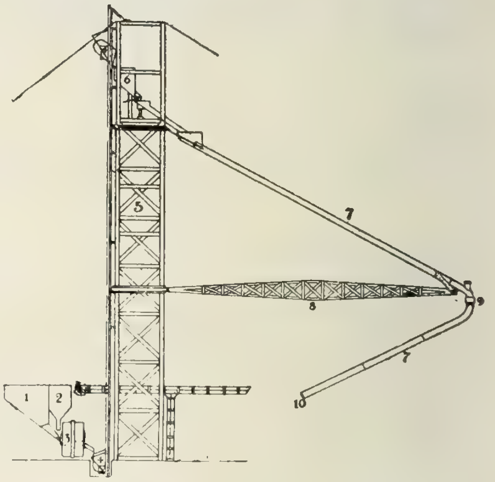

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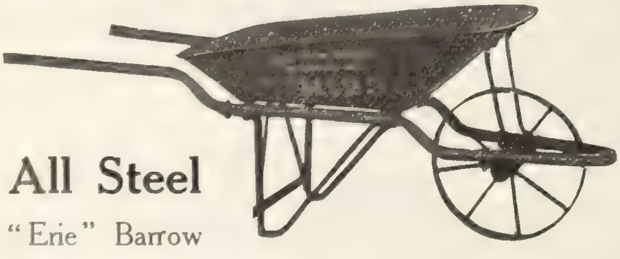

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ERIE

This is a deep barrow for carrying concrete or other sloppy material. Wheel guarded and forward dump.

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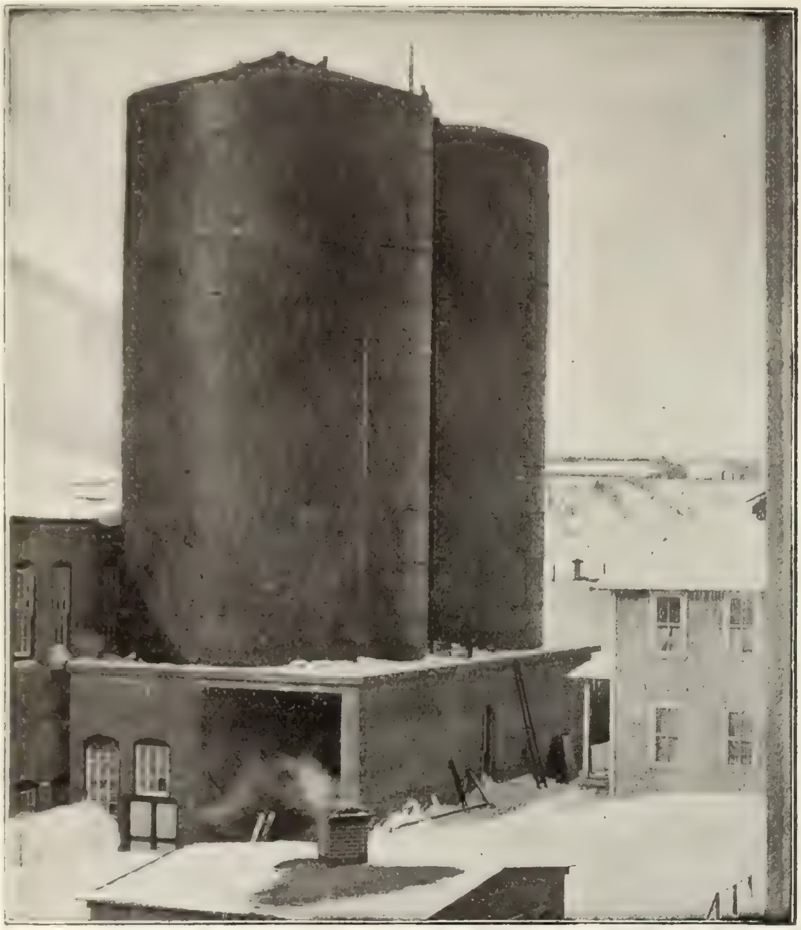

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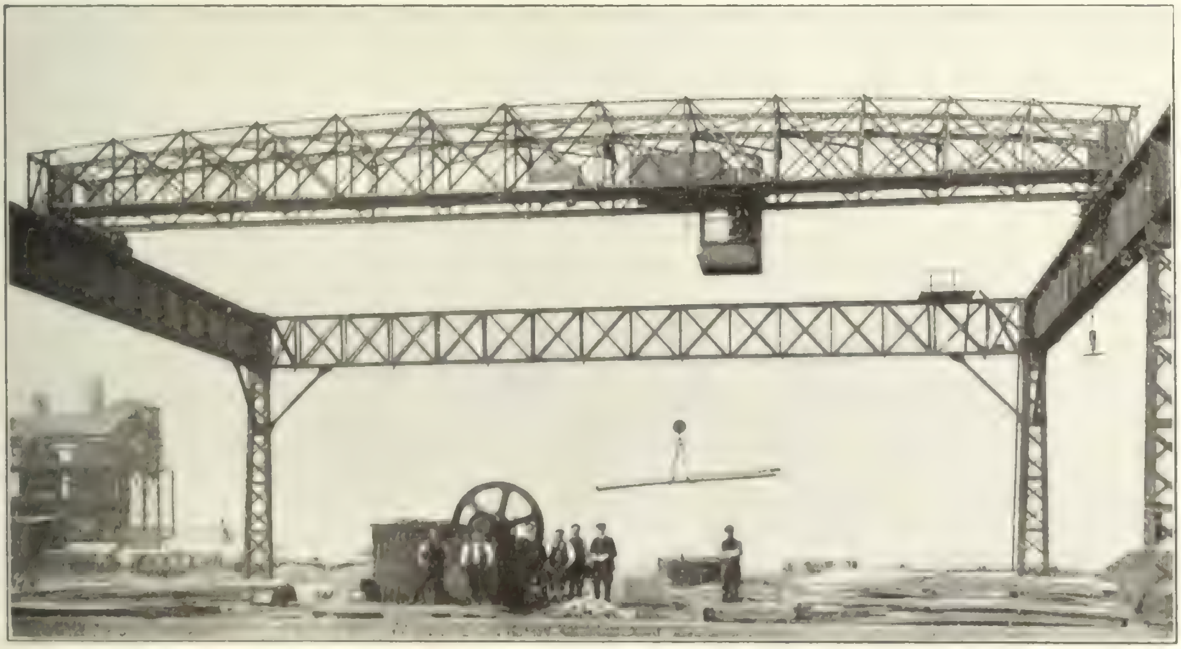

Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

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Electrical Cranes Capstans Telfers Winches

Include Royce Crane Type Motors, Controllers, Over Hoisting Safeguard.

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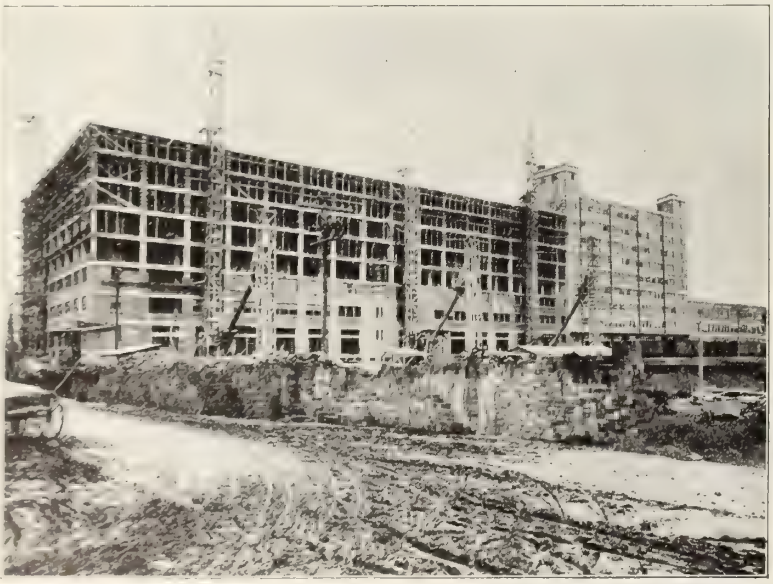

View of Sears-Roebuck Company Building, under construction, Dallas, Texas

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The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

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THE MUSHROOM SYSTEM

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For designs, estimates and suggestions embodying the best of our long experience, you have only to consult our Engineers, without any obligation on your part.

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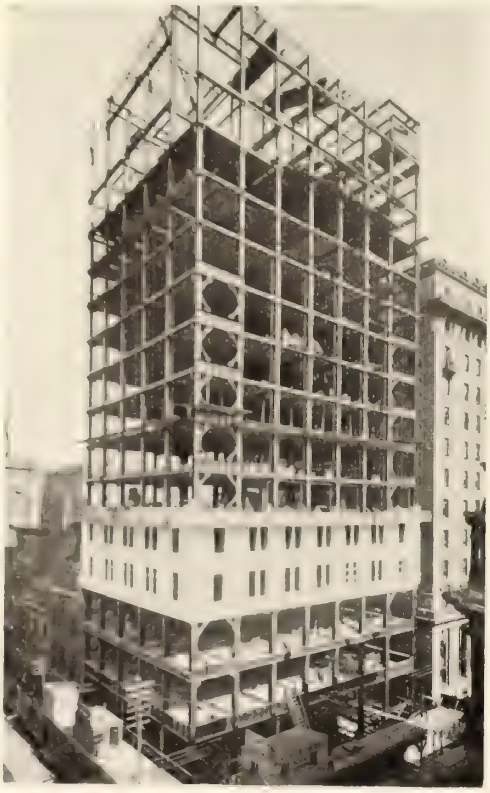

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The Structural Steel of

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The use of this Paint absolutely insures steel against damage by Rust or Electrolysis.

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Because it has Twenty-five years of **proven** service to its credit.

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It would be entirely to your advantage to have competitive prices on your requirements, and to have our prices even if only as a matter of record.

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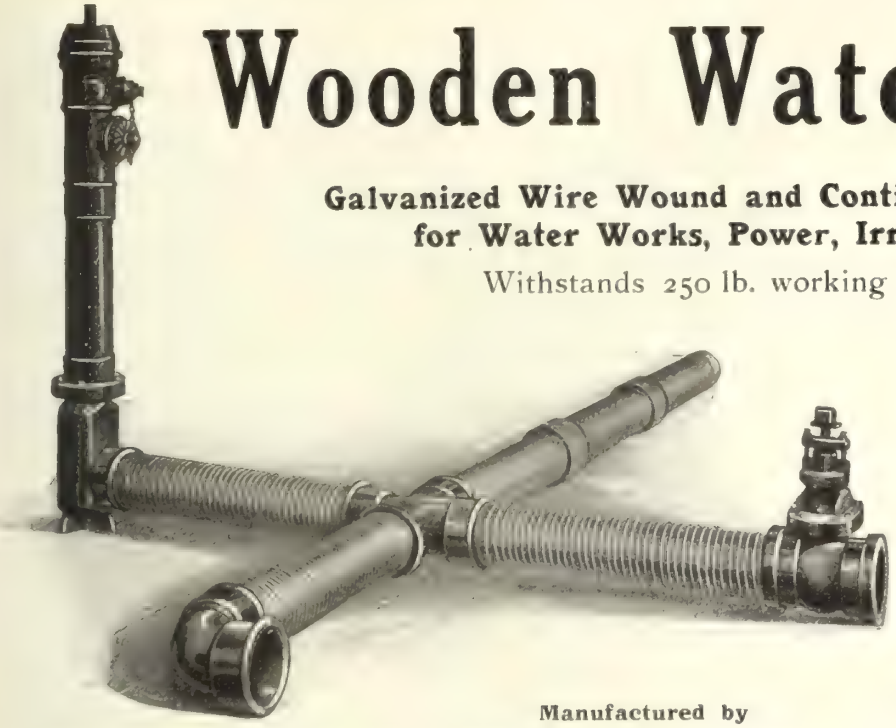
Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.



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We specialize in

The Built up Pitch, Felt and Gravel Roofing, Damp-proofing Foundations, Slating, etc.

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We will quote you attractive prices on any of the above—write us

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The Dunn Wire-Cut-Lug Brick Company's Licensees now number seventeen separate companies—many of them operating two or more plants, and the list including the largest paving brick manufacturers in the world with an annual output of more than 300,000,000, who are manufacturers of the Perfect Paving Block. The list to date follows:

Dunn Wire-Cut-Lug Brick Co. - Conneaut, Ohio

LICENSEES:

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United Brick Co.	Conneaut, Ohio.
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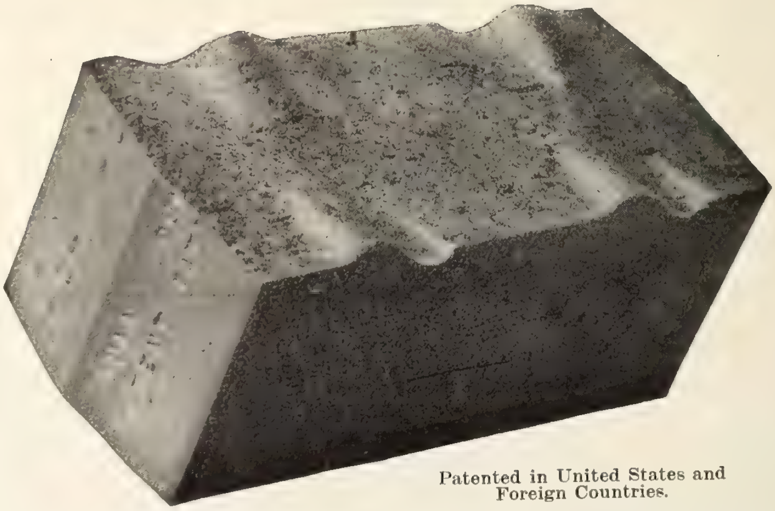
The Dunn Wire-Cut Lug Block Makes the Perfect Pavement

The Improved Dunn Block

Note the four lugs and grooves formed in wire cutting. These insure even spacing and leave ample space for distribution of the grout filler. The lugged face and the one opposite are rough to make the filler adhere.



Patented in United States and Foreign Countries.

The Double Bevelled Ends Insure Good Bonding

Note the sharp, square edges. These allow the filler to be poured flush with the pavement. It will not break away at the surface as it will with the round edged "Repressed" Block.

Our Engineers Subject to Your Call

Use their advice any time—call them anywhere the Dunn block is used. The Dunn Wire-Cut-Lug Brick Company's Engineering Department was created and is maintained for the sole purpose of co-operation with all municipal, county and state officials in an effort to insure the best possible construction of Dunn Wire-Cut-Lug Block Streets. W. C. Perkins, formerly with the New York State Highway Department, is at the head of our Engineering Department and associated with him is Frank T. Townsend; and also, as consulting engineer, Mr. W. T. Blackburn, who has a nation-wide reputation as an expert in highway engineering.

The Dunn Wire-Cut-Lug Block is worthy of a business man's investigation. We court the opportunity to show you what this block really is and what it means to the manufacturer.

The Dunn
Wire-Cut-Lug Brick Co.
Conneaut, Ohio

Patented in Canada and the United States

UNITED STATES GOVERNMENT MODEL ROADWAY—Chevy Chase, Md.

THE section of the government model roadway shown in the photograph is paved with WIRE-CUT-LUG BLOCKS (Patented.)

It represents perfect monolithic construction, as the joints between the brick are completely filled with cement grout. The square edges of the WIRECUT-LUGBLOCK afford a surface that is even and smooth but not slippery. Leading paving brick manufacturers reaching every section of the country are now making this perfect type of paving block.

Our engineering corps will personally show you how to duplicate this excellent construction. Their services are freely given wherever called for.

Dunn Wire-Cut-Lug Brick Company

Conneaut, Ohio

Patented in Canada and United States

Some Reasons Why

Wire-Cut-Lug Brick are Supreme

Uniform Density—maintained of cutting lugs with wire at same time brick is cut from prism. Neither form, density, nor structure of brick is changed.

Bond—Lugs formed by wire cutting holds bricks apart with four points of contact, allowing grout filler binder to flow freely between the brick, the uniformity of lugs making perfect alignment in laying of bricks in pavement.

Surface—Square edges of block, allowing filler to be brought flush with surface, achieving monolithic construction with a smooth even pavement.

Economy in Laying—The uniformity of the lug and size of bricks, with a flat surface on the side opposite the lugs, enables the bricklayer to lay more square yards of wire-cut-lug pavement in a day than under ordinary circumstances.

Filler—The cement filler filling every interstice between the bricks forms, as it hardens, a solid block of pavement, bound from the surface to the sand-cushion in a single monolithic slab the width and length of the street.

Durability—The integral strength of the brick used, the perfect protection given the sharp edges by the grout lying flush with the surface, assumes a durable and permanent Pavement, easy to clean and sanitary.

Maintenance Cost—Owing to the hardness of the brick and the integrity of the pavement, due to practically indestructable binding, the wire-cut-lug vitrified brick pavement solves the problem of reducing the cost of maintenance to an irreducible minimum.

Dunn Wire-Cut-Lug Brick Company
of Conneaut, Ohio, U. S. A. **(Licensors)**

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The Permanant Way

Wire Cut-Lug Blocks Cost No More than Ordinary Paving Brick.

Wire-Cut-Lug Blocks on the Buffalo-Glenwood Road, 6½ miles from the Buffalo city line, laid by the New York State Highway Department.

The competing manufacturers of Wire-Cut-Lug Blocks are in position to supply your requirements at the same prices you would pay for ordinary repressed paving brick.

Why not buy the best?

Leading Paving Brick Manufacturers reaching every section of the country are now making this perfect type of paving block. Our engineering corps will personally show you how to obtain the best results in your construction. Their services are freely given wherever called for.

Use Wire-Cut-Lug Blocks this season and secure the pre-eminent permanent pavement.

The Dunn Wire-Cut-Lug Brick Co.

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CONNEAUT, OHIO.

Patented in Canada and the United States

Buffalo Single Cylinder Double Acting Power Pump

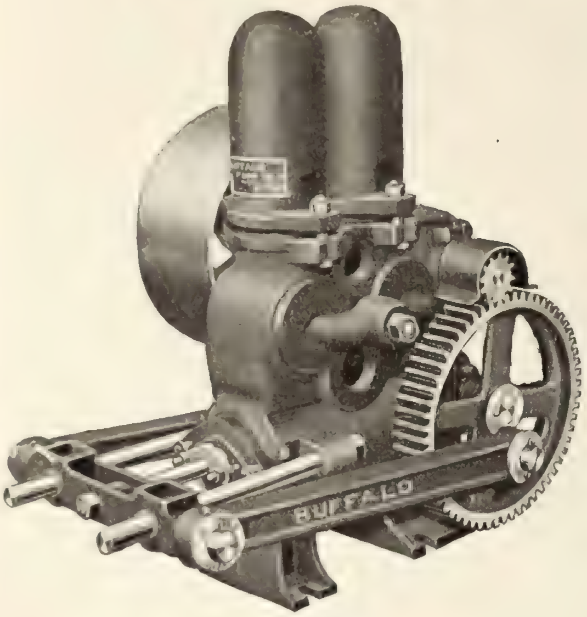

Fig. 401

The power pump illustrated is a distinct departure from the older competing designs now on the market. It will be noted that both the suction and discharge openings are above the cylinder. Because the suction valves are above the water piston the water contained cannot leak out when the pump is stopped. In other words the pump always stays primed and will immediately pick up its suction after a long period of rest because the cup leathers will not have dried out. This design is by far the best for handling water through long suction pipes and for the greatest convenience of operation. Two large air chambers are provided directly above the discharge valves where they are doubly effective and as they are easily detached the discharge valves are easily accessible. The suction valves are reached through two cover plates both of which may be taken off by removing one nut.

Metal to metal ground joint between head carrying crankshaft bearing and the main cylinder casting, giving absolutely accurate alignment.

Pump cylinders are brasslined, valves, valve seats and gland are brass; piston rods are brass fitted.

All bearings are lined with high grade babbitt and provided with large grease pockets with hinged covers.

Suction and discharge openings are provided on both sides of the pump.

Built in sizes 10 to 100 gallons per minute.

Send for Circular No. 255-C12.

Buffalo Steam Pump Co.
Buffalo, N. Y.

—Sole Canadian Agents—

Canadian Buffalo Forge Co., Limited
Berlin, Ontario
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Engineers and Contractors

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Sewage Disposal in the United Kingdom, by Henry Lemmoin Cannon. Published in 1912 by St. Bride's Press, London, Eng. 320 pages; illustrated. Price $1.00.

Strength of Materials, by Edward H. Maurer. Published in 1908 by American School of Correspondence. 128 pages. Illustrated. Price 75c.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price $1.50.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price $1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00.

Engineering as a Vocation, by Ernest McCullough. Published in 1911 by David Williams Company, New York. 200 pages. Price 50c.

The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons. 102 pages. Illustrated. Price 50c.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited, London. 618 pages, well illustrated. Price $2.00.

A Treatise on the Inspection of Concrete Construction, by Jerome Cochran, C.E. Published by Myron C. Clark Publishing Company. 594 pages. Price $3.00.

Reinforced Concrete Construction, by George A. Hool, S. B. Published in 1913. Volume II. 666 pages, illustrated. Price $4.00.

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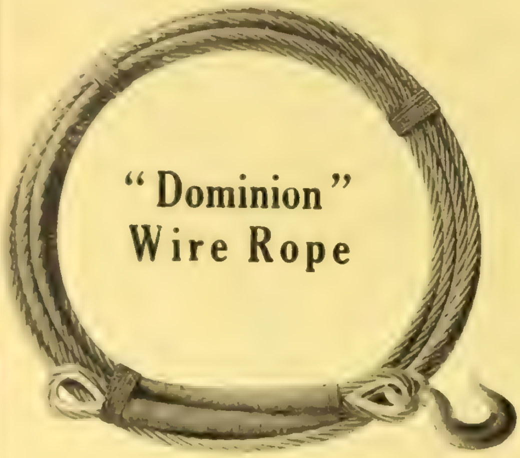
Successors to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C.P.R. Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.



WIRE ROPE

Suitable for any requirement

We carry in stock all sizes and lengths wire rope for

Hoisting, Haulage, Guys, Semaphores, Transmission of Power, Towing, Bridges, Mines, Derricks, Cranes, Cableways, Coal Towers, Etc.

We manufacture special ropes to take care of your particular needs.

WIRE ROPE FITTINGS, BLOCKS, CLIPS, ETC. IN STOCK

The Dominion WIRE ROPE Co. Ltd.
MONTREAL

"Industrial Works"
Locomotive-Coaling and Wrecking

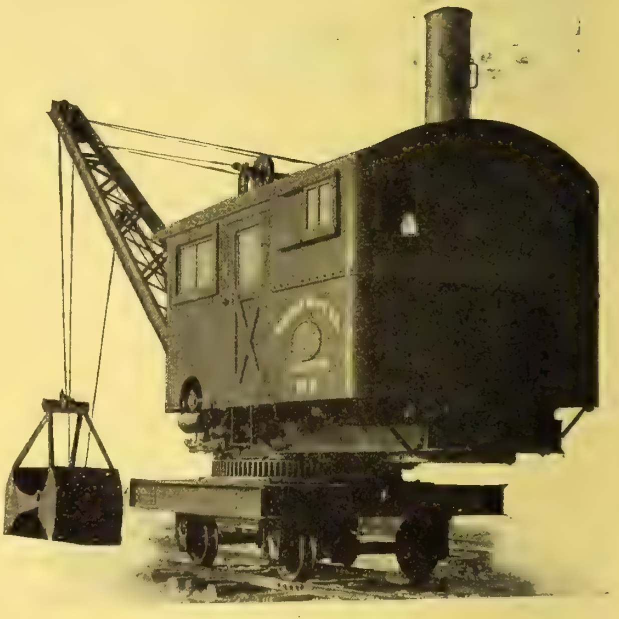
CRANES

In capacities from
5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS

For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., HEAD OFFICE MONTREAL

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

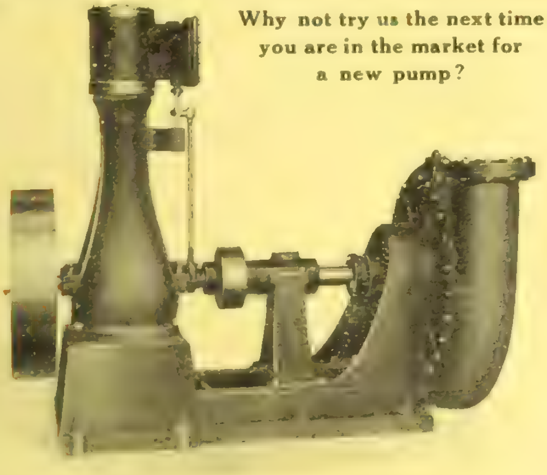
Vol. 28 Toronto, June 3, 1914 No. 22

ESTABLISHED 1886

Contract Record and Engineering Review

Our PUMPS are in use from Coast to Coast

Why not try us the next time
you are in the market for
a new pump?



The Smart-Turner Machine Co., Limited
Hamilton, Canada

"MADE IN CANADA"

Bent Glass

Made in all
Kinds of
Glass
on Short
Notice

Large Bent Plate Glass for Shop
Fronts a Specialty

The Toronto Plate Glass Importing
Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

Air Compressors
OF BELLISS MAKE
have gained their reputation for

- Simplicity of Design
- Noiseless Running
- Compact Design
- Low Oil Consumption
- Continuous Operation
- Overall Efficiency

Messrs. Belliss & Morcom, Ltd.
BIRMINGHAM, ENGLAND
Agents
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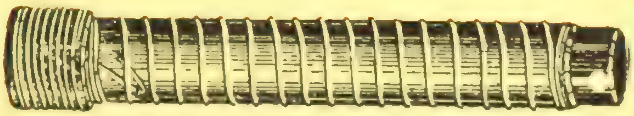
Board of Trade Building, MONTREAL



Continuous and Machine Banded Wood Stave
WATER PIPE
RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

"Announcement"

In addition to a full line of other types of crushing machinery and equipment we are now building

Gyratory Crushers

of most modern design and equipped with an improved

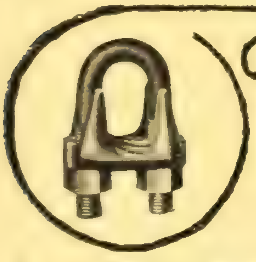
Water Cooled Eccentric Bearing

Made in all sizes for all capacities and for crushing any kind of material.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catherines Toronto Montreal Cobalt South Porcupine
Vancouver and Nelson



Here is a Genuine
"CROSBY" CLIP

The Genuine Crosby Clip is the Ideal Reinforcement Bar Connection

Part of the Steel work of the Duluth Reservoir

Here is how the "CROSBY" Clip is used to connect reinforcement bars

It has made possible such efficient yet economical reservoirs as those constructed by the city of Duluth, Minn., the state of Illinois at Anna, Ill., and by the Anheuser-Busch Brewing Co., at St. Louis, Mo. Full particulars on request.

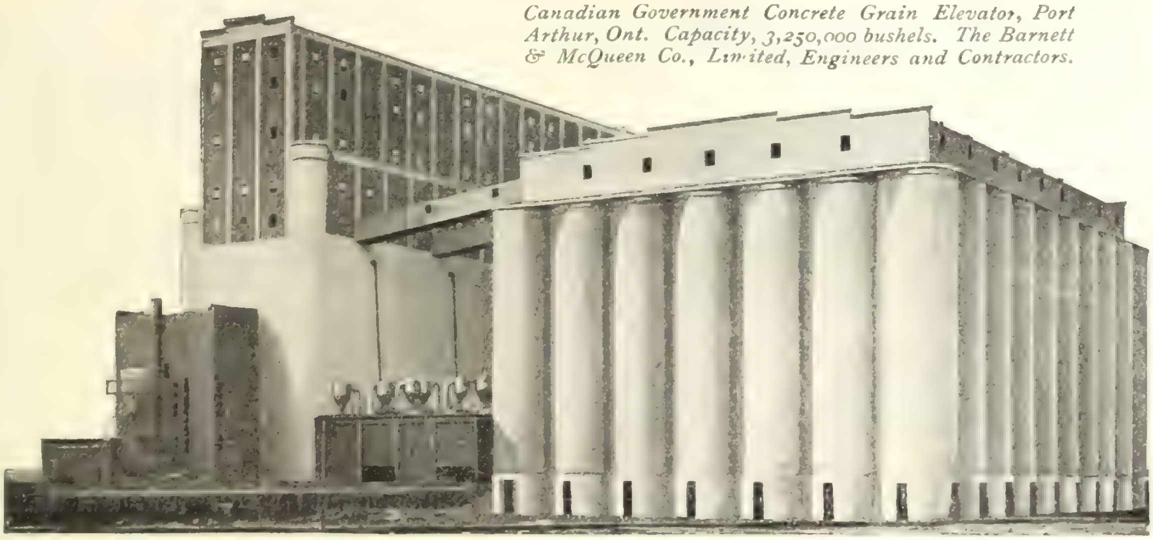
The "CROSBY" Clip is drop forged from a special grade of steel—galvanized to prevent rust. It has tremendous gripping power. Once tightened, it will not pull out, break out, nor rust out.

MANUFACTURED BY

AMERICAN HOIST & DERRICK CO.

St. Paul, Minn., U. S. A.

SOLD BY: General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot, Ltd., Vancouver, B. C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.



Canadian Government Concrete Grain Elevator, Port Arthur, Ont. Capacity, 3,250,000 bushels. The Barnett & McQueen Co., Limited, Engineers and Contractors.

Government Adopts Concrete

The best evidence of the practicability and economy of concrete for the building of large structures, is contained in this illustration of the Canadian Government Concrete Grain Elevator at Port Arthur, Ontario.

The practicability and economy of concrete lie in its adaptability to any structural design, its great strength and its durability. It is unburnable, practically indestructable and

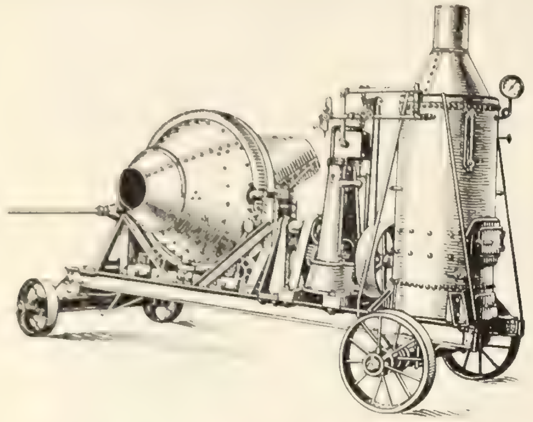
Minimizes Maintenance Cost

Concrete, on account of its adaptability affords unlimited possibilities in the design of all classes of structures. The fact that the greater part of the materials and labor that go into a concrete structure may be obtained locally makes its use economical and convenient from the viewpoints of both engineer and contractor.

Complete information about concrete structures will be sent to anyone interested, without charge. State nature of building on your postal card of request.

Information Department

Canada Cement Company
Limited
881 Herald Building, Montreal



SMITH CONCRETE MIXERS

READ

what these Contractors say about the

"SMITH"

They Operated Three No. 5 Smith Mixers

5130 Cubic yards in 162 hours

If others can get these results—so can you if you use a "SMITH"

Ottawa., May 21st. 1912.

Messrs.
Mussens Limited,
Montreal, P.Q.

Gentlemen :-

In Ottawa during a six days run, with three Smith Mixers operating, we placed on an average of 285 cubic yards of concrete a day with each Mixer, or 31.7 yards per hour per Mixer.

We consider this an excellent record, one to be proud of, as there were intervals during the six days that we were unable to keep all Mixers operating.

This work was under the supervision of the Government Inspector who can verify the above statement.

O'Toole & MacGillivray
CONTRACTORS.
for the New Plaza.
Ottawa.

D. A. Williamson
Engineer in Charge.

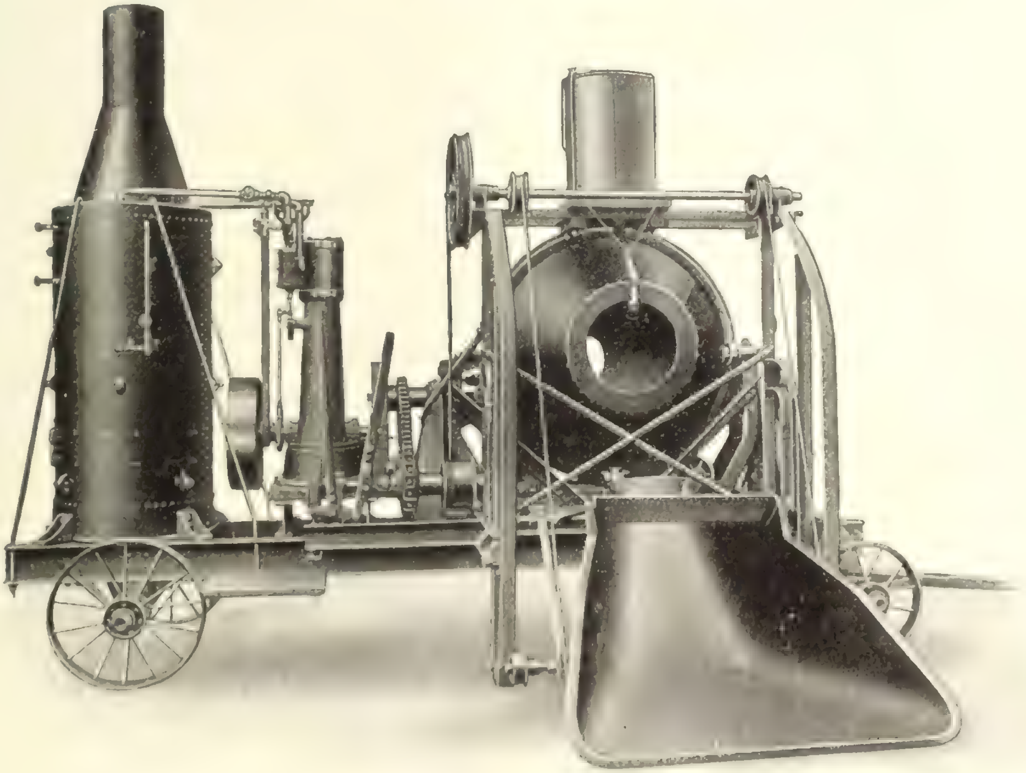
Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N. B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE

SMITH MIXER

Is the easiest on repairs, the strongest and most reliable mixer on the market



Built Right Works Right
The Mixer That Never Fails

Mussens Limited

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TORONTO, 155 West Richmond St.
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WINNIPEG, 259-261 Stanley Street
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- Canadian Allis Chalmers, Limited
- Canadian Fairbanks-Morse Co.
- Can. Ingersoll-Rand Co., Ltd.
- Jenckes Machine Company

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Architects' Instruments
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- W. & L. E. Gurley.

Architectural Iron Work
- [illegible] Architectural Iron Works
- Canadian Allis-Chalmers, Limited
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- Dennis Wire & Iron Works
- Eberhard & Wood
- [illegible] Bros. Company
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- Gerald Lomer, Ltd.
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- Hydraulic Press Brick Co.
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- Sutcliffe, Speakman & Co.
- Weller Mfg. Company

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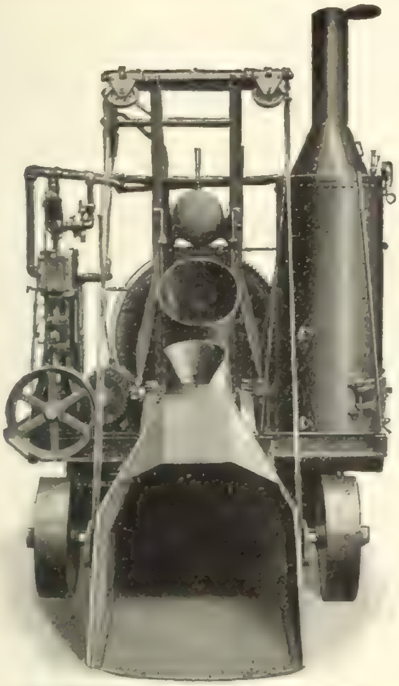
(Continued on page 10)



M-C Rail-Track Paver with Steam Power
Showing Pivoted End Hoist

Here's the Paver for You!

THE M-C Rail-Track Paver is backed by M-C reputation. Every claim made for it is made in absolute sincerity by the manufacturers. Note the construction of an M-C Paver.

Extra Large Capacity—11 cubic feet of mixed concrete, 2-bag batch 1-3-5

Surplus Power—10 h.p. Steam Engine with 12 h.p. Boiler or 12 h.p. 2-cylinder gasoline engine.

Two Traction Speeds—½ and 1¾ miles per hour ahead. 1 mile per hour reverse.

Extra large wheels—Rear, 36″ diameter by 10″ face. Front, 30″ diameter by 10″ face,

For Narrow Roads—A simple 8 ft. chute for spreading on narrow roads.

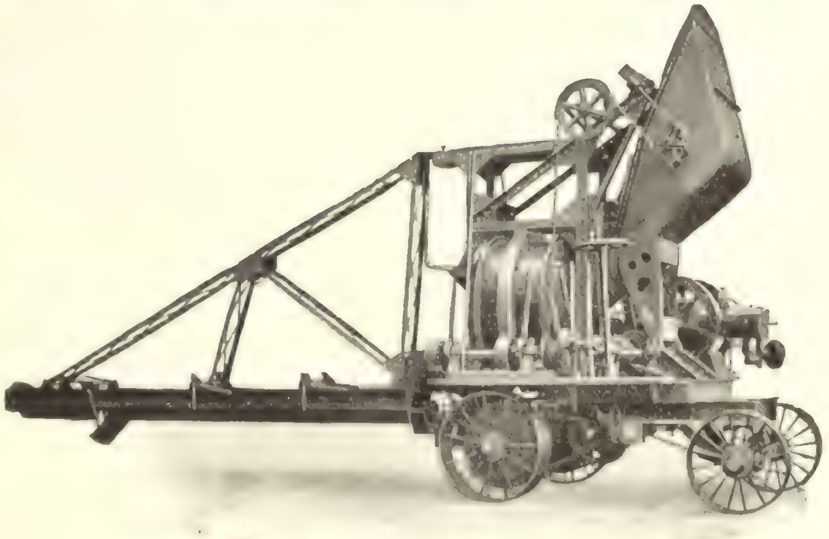
For Wide Streets—A remarkable 16 ft. boom for spreading on wide streets. This boom gives the concrete an extra mix, delivering anywhere between the mixer and the end of the boom.

Other Features—An efficient set of brakes—a powerful differential gear—perfect one-man control—high discharge for dumping into carts—all weight carried very low so machine can't overturn.

M-C Rail-Track Pavers

M-C Rail-Track Pavers have all the good features found in other street or road paving machines. And many that the others have not. That's why big contractors and machinery experts—men who give careful thought to road and street concrete paving mixers the country over, insist upon M-C equipment, which means

"Most Mixing
Least Fixing"



M-C Rail-Track Paver with Gasoline Engine, showing Delivery Boom

Send to nearest agent for full information

CANADIAN FAIRBANKS-MORSE CO., Limited

MONTREAL ST. JOHN OTTAWA TORONTO HAMILTON VICTORIA VANCOUVER

Manufactured by **Marsh-Capron Mfg. Company** 465 Old Colony Bldg.
CHICAGO

Canadian Consolidated Rubber Company
Limited

Executive Offices, Notre Dame Street, MONTREAL, P. Q.

Selling Agents for

Dominion Tire Company, Limited, Berlin, Ont.
The Canadian Rubber Company of Montreal, Limited, Montreal, Que.
The Granby Rubber Company, Limited, Granby, P.Q.
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Dominion Rubber Company, Limited, St. Jerome, P.Q.
Berlin Felt Boot Company, Limited, Berlin, Ont.

Rubber Goods Best by Test for all Purposes

- **Air Brake Hose (regular) and Special "Nonfreezing"**
- **Air Signal Hose**
- **Steam Heating Hose**
- **Vacuum Hose**
- **Hot Water Hose (White)**
- **Cold Water Hose**
- **Air Hose—for Drills and Pneumatic Tools**
- **Hose Bags—Corrugated**
- **Heavy Suction Hose**
- **Wire-lined Gas Hose**
- **Fire Hose and Supplies**
- **Hose for every special use**

- **"Star" Red Sheet Packing**
- **"Canadian" Spiral Packing**
- **Pure Gum Sheet**
- **Valves—For Hot and Cold Water (all densities for any pressure)**
- **Pebbled (Dot) Rubber**
- **Moulded Mats**
- **Hammer Bumpers**
- **Air Brake Gaskets**
- **Special Moulded Goods for every mechanical use**
- **Tubing—all sizes**
- **Rubber Strips**

Rubber Boots and Shoes

"Jacques Cartier," "Merchants," "Dominion," "Anchor," Brands.
Fleet Foot Outing and Sporting Shoes. Felt Boots and Specialties "Berlin" Brand.

Automobile Tires Truck Tires Carriage Tires

Original "Diamond" designs Inlaid Rubber Tiling. Estimates and samples cheerfully furnished. We specialize in Rubber Goods required by Steamboat and Electrical Car Companies. Write for catalogues and prices.

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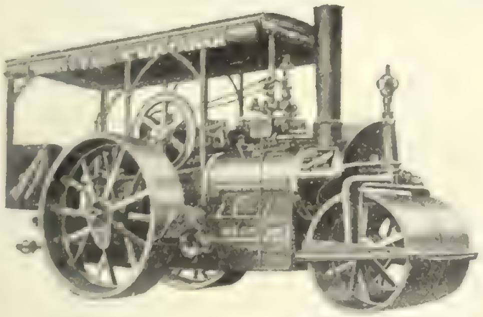
Calgary Edmonton Saskatoon Regina Vancouver Victoria

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

Head Office and Works

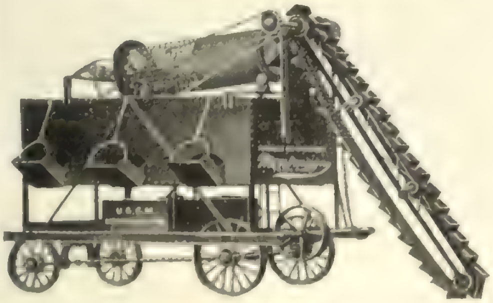


"Montmagny" Steam Road Roller.

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

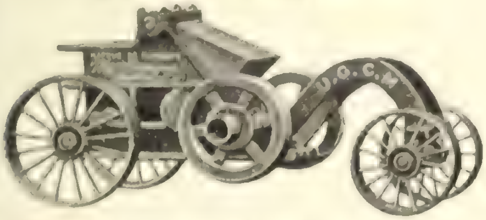
Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



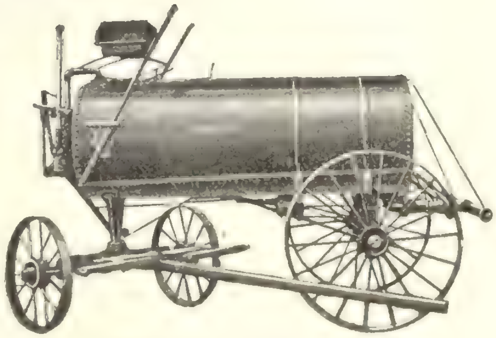
"Montmagny" Portable Steel Bin.

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.



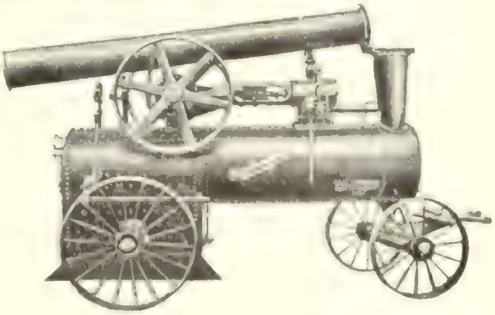
"Montmagny" Stone Crushers.

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.



"Montmagny" Road Sprinkler.

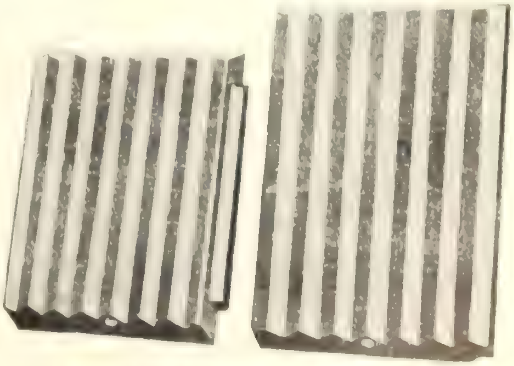
The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.



"Montmagny" Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.

For crushing field stone, granite, etc., "Montmagny" jaws are made of manganese steel. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.



"Montmagny" Manganese Steel Jaw Plates

"Montmagny"

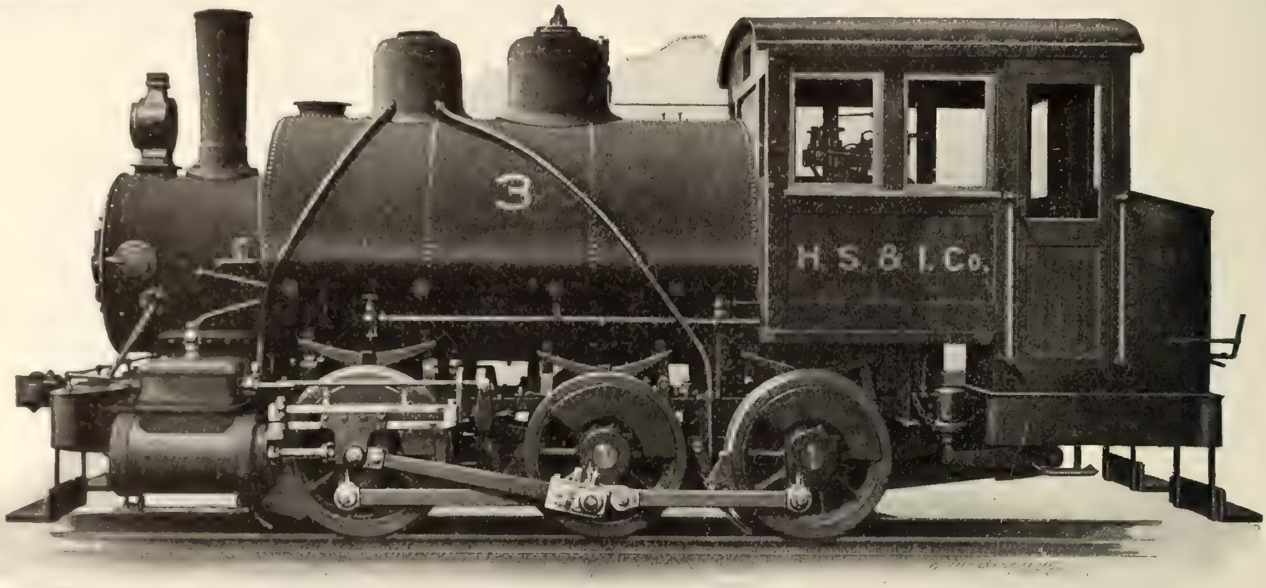
Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA
TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

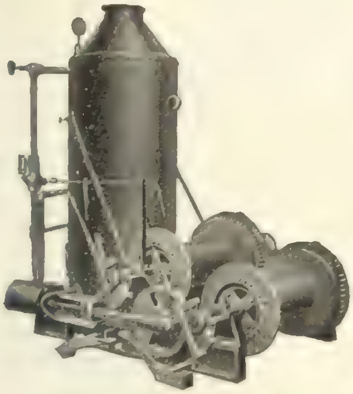
HIGH-GRADE VITREOUS FACE BRICKS

can be used to advantage in

Small Shop Fronts
Gateways, Fireplaces.

We have several lots in Grays, Buffs, Browns and Reds, in both rough and smooth textures, which we are clearing out at specially reduced prices.

BLACK BUILDING SUPPLY COMPANY, LIMITED
202 MAIL BUILDING TELEPHONE MAIN 331



Standard Hoisting Engine

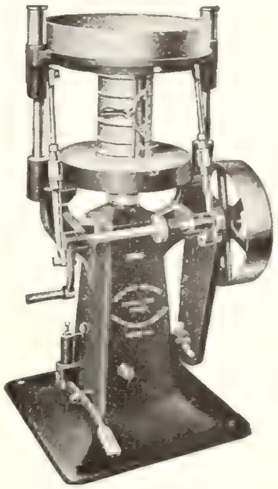
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur, Ont.—Northern Agency Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



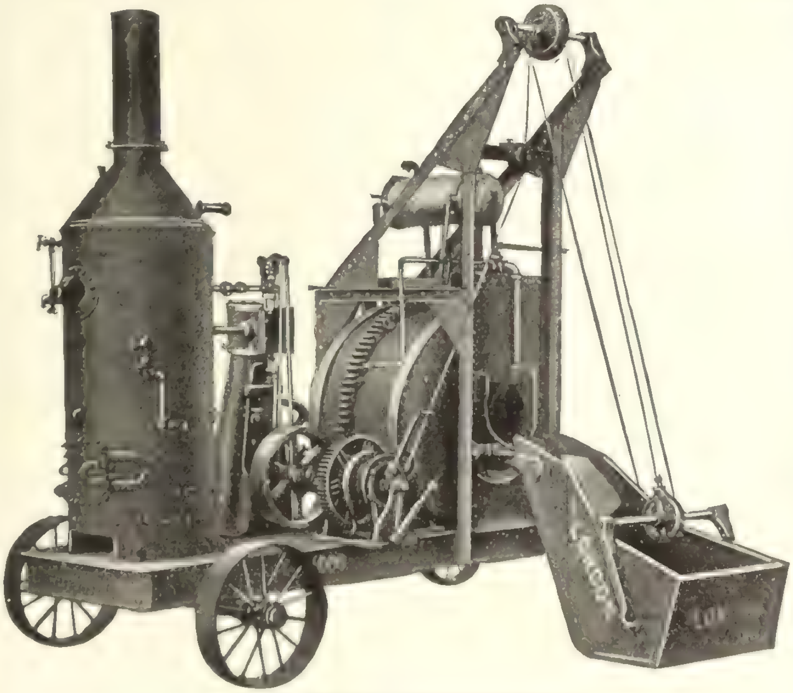
Dunn Cement Drain Tile Machine

Concrete Mixers

Mortar Mixers

Concrete Block Machines

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

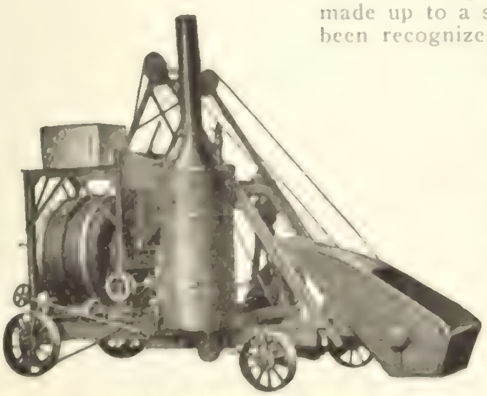
Rock Crushers

Pumping Outfits

Hoists and Derricks

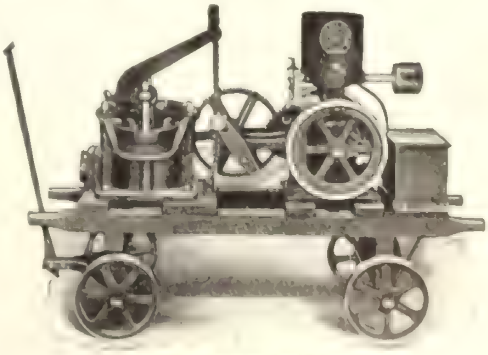
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader

Correspondence Solicited.



Diaphram Pump with Power

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- Drop Forgings
  - Canadian Billings & Spencer, Ltd
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  - Bechtels Limited
  - Manitoba Bridge & Iron Works
  - Sewell Foundry & Machine Co.
  - Western Wheeled Scraper Co.
  - Weller Mfg. Co.
  - Sheldons Limited.
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  - Troy Wagon Works
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- Electric Fans
  - Sturtevant Co. of Can. Ltd. B. F.
- Electric Air Rock Drills
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- Electric Impulse Clocks
  - [illegible]
- Electric Steel Castings
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- Elevators
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- Enamelled Brick
  - American Enamelled Brick & Tile Company
  - National Builders' Supply & Enamel Concrete Brick Co.
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  - Laurie & Lamb
  - Leonard & Sons, E.
  - McDougall Caledonian Iron Wks
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  - Municipal Engineering & Contracting Company.
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  - Canadian Buffalo Forge Co.
  - Sheldons Limited
- Expansion Bolts
  - Star Expansion Bolt Co.
- Expanded Metal
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  - Pedlar People Limited.
- Fans
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  - Sheldons Limited.
  - Sturtevant Co. of Can. Ltd. B. F.
- Fuel Economizers
  - Sturtevant Co. of Can. Ltd. B. F.
- Electrical Machinery and Supplies
  - Ferranti Electrical Co.
  - Sturtevant Co. of Can. Ltd. B. F.
- Field Instruments
  - Gurley, W. & L. E.
- Filters
  - American Water Softener Co.
- Fire Brick
  - Ontario Lime Co., Ltd.
  - Smyth & Ryan
- Fire Escapes
  - Manitoba Bridge & Iron Works.
  - McGregor & McIntyre
- Fireproof Doors and Windows
  - Feather & Roadhouse
  - Hope & Sons, Henry.
  - Mussens Limited
  - Pedlar People Limited.
  - Steel & Radiation Limited
- Fuse (Safety Blasting)
  - Lecky & Collis
- Fixtures (Gas)
  - Consumers Gas Co.
- Floor and Wall Tile
  - Frontenac Floor & Wall Tile Co.
- Folding Doors
  - Springer, O. T.
- Forges
  - Canadian Buffalo Forge Co.
  - Sheldons Limited
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- Forgings
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  - British Mfrs. Assn. of Canada.
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  - Armstrong Mfg. Co.
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  - Original Gas Engine Co.
- Glass
  - Consolidated Glass Co.
  - Excelsior Plate Glass Co.
  - Hobbs Mfg. Co.
  - Luxfer Prism Co.
  - Pilkington Bros.
  - Toronto Plate Glass Imp't'g Co.
- Hammer Drills
  - Canadian Ingersoll-Rand Co.
- High Pressure Pipe Lines
  - Boving Company of Canada
  - Escher Wyss & Co.
  - Mannesmann Tube Company.
  - Pittsburgh Valve, Foundry & Construction Company
- Hoisting Apparatus
  - American Hoist & Derrick Co.
  - Beatty & Sons, M.
  - Browning Company
  - Brown Hoisting Machinery Co.
  - Canadian Allis-Chalmers, Ltd.
  - Canadian Fairbanks-Morse Co.
  - Canadian Ingersoll-Rand Co.
  - Jenckes Machine Co.
  - Hopkins & Co., F. H.
  - Lecky & Collis
  - Marsh & Henthorn
  - Morris Hoist & Crane Co., Herbert.
  - Mussens Limited
  - Rock & Power Machinery
  - Royce Limited
  - Sturtevant Co. of Can. Ltd., B. F

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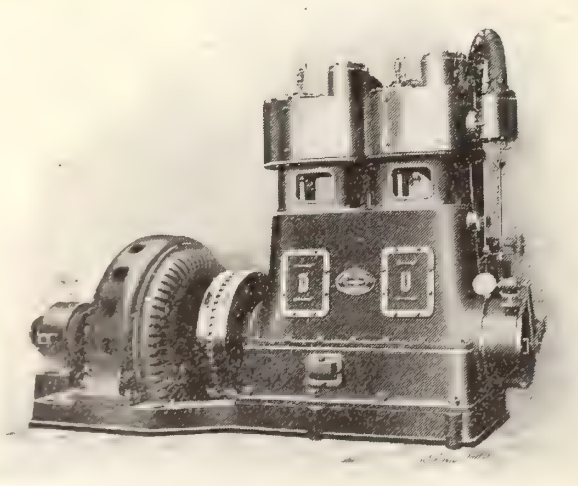
BRUCE PEEBLES



Peebles-Browett Alternator Set

Alternators and Generators

are built suitable for belt-drive or for direct coupling to any form of prime mover.

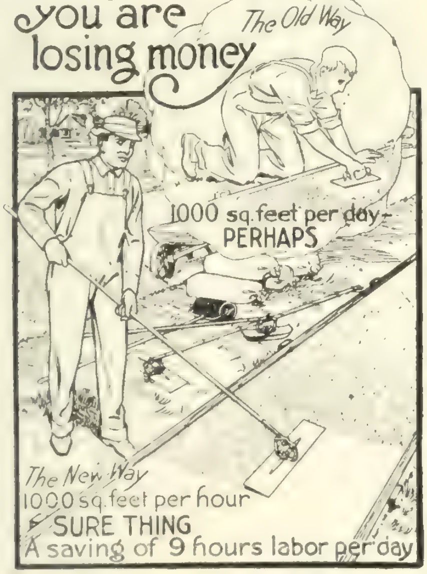
Send Us Your Enquiries

The Ferranti Electrical Co. of Canada, Ltd.

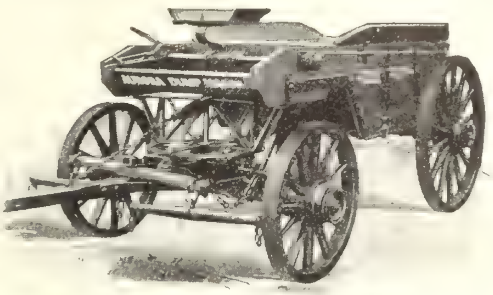
90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, **WINNIPEG**

If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money



Abram Cement Tool Co.,
Windsor, Ontario



The Western Dump Wagon

embodies lightness with strength and durability and capacity with ease of operation.

This wagon has met with enthusiastic praise among contractors and other users.

Improvements have been made at every point possible with a view of facilitating the dumping of the material and admitting of greater expedition.

Our illustrated catalogue will interest you—write for it.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Heating Apparatus
Canadian Buffalo Forge Co
Canadian Sirocco Co.
Sheldons Limited

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Northern Crane Works.
Stratford Mfg. Company

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

Industrial Cars
Central Locomotive & Car Works

Insulating Compounds
Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
Batts Limited
Canada Office & School Fur. Co.
Rhodes Curry & Co.

Jib Cranes (all kinds)
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Morris Crane & Hoist Co., Herbert.

Kilns
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Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
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Berg Machinery Mfg. Co.

Lime
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Jamieson Lime Co.
Ontario Lime Co., Ltd.
Standard White Lime Co.

Lighting and Pumping Installations
Lister & Co., Ltd., R. A.

Locks
Can. Yale & Towne Ltd.

Locomotives
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Central Locomotive & Car Works
Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
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F. H. Hopkins Co.
Mussens Limited

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Stark Rolling Mill Co.

Metal Lath
Greening Wire Co., B.
Metallic Roofing Co.
Noble, C. W.
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Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

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Dominion Paint Works
Hopkins & Co., F. H.

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Asphalt & Supply Co.
Aztec Oil Asphalt Co
Bessemer Limestone Co.
Baker Co., R. D.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Dunn Wire-Cut-Lug Brick Co.
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

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American Spiral Pipe Works
Canadian Allis-Chalmers, Ltd.
Canadian Pipe Co.
Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
Gerald Lomer, Ltd.
Mannesmann Tube Company.
National Concrete Mfg. Co.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
Steffens & Nolle
United States Cast Iron Pipe Co
Vancouver Wood Pipe & Tank Company.
Walsh Plate & Structural Works.

Partition Hangers
Springer, O. T.

Paints (Bridge and Structural Iron and Pipe Coating)
Dominion Paint Works

Perforated Metals
Canada Wire & Iron Goods Co.
Greening Wire Co., B.

Pipe Machinery
Sutcliffe, Speakman & Co.

Pile Driving Machinery
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Pipe Fittings and Flanges
Pittsburgh Valve, Foundry & Construction Company

Plumbing Supplies
Mueller Mfg. Co., H.

Planing Mill Exhausters
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.

Plaster
Alabastine Hardmortar Co.
Albert Mfg. Company
Britnell & Company
Ontario Lime Co., Ltd.

Plate Glass
Excelsior Plate Glass Co.
Pilkington Bros.

(Continued on page 18)

Right Goods at Right Prices

Contractors' Tools, like all other engineering supplies when bought right, are bought on an efficiency basis. It is not a question of cheapness but one of "will they give me the greatest value for my money?" "Are they durable and are they designed right to get the most work out of my men?" Our line of Contractors' Supplies is carefully selected to meet every demand made upon them.

Among others, we carry a full stock of M-C Rail Track Concrete Mixers, Barrett Jacks, K. & J. Wheelbarrows, Star Dump Wagons, Tackle Blocks, Hoisting Engines, Tools, etc.

The Canadian Fairbanks-Morse Co., Limited
Montreal Quebec St. John Toronto Ottawa Hamilton Ft. William
Winnipeg Regina Saskatoon Calgary Edmonton Vancouver Victoria

Canada's Departmental House for Mechanical Goods

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

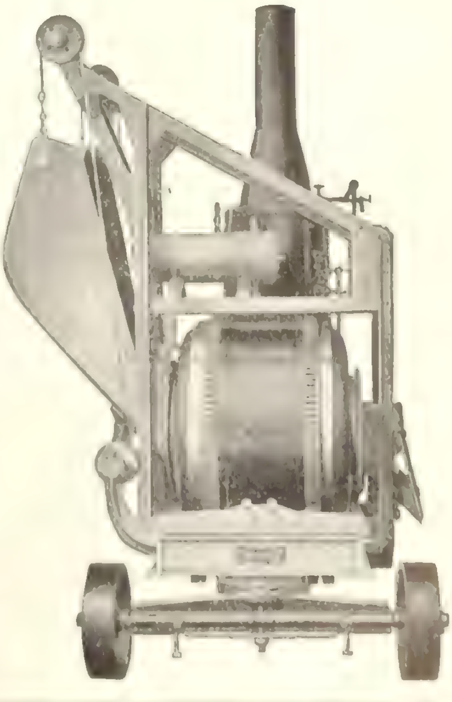
Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.



KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

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Pneumatic Machinery
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Pumps and Pumping Machinery
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- Canadian Sirocco Co.
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- Rock & Power Machinery
- Wettlaufer Bros.

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Portable Track
- Bechtels Limited

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- Sutcliffe, Speakman & Co.

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- Canadian Ingersoll-Rand Co.

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- Jenckes Machine Company
- Canadian Allis-Chalmers, Ltd.
- Waterous Engine Works

Quarry Machinery
- Canadian Allis-Chalmers, Ltd.
- Canadian Ingersoll-Rand Co.
- Improved Equipment Co.
- Jenckes Machine Company
- Lecky & Collis
- George Anderson & Co.
- Goodwin, Barsby & Company.
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Railway Supplies
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- Hopkins & Co., F. H.
- Lecky & Collis
- Mussens Limited

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- Brown Hoisting Machinery Co
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- Greening Wire Co., B.
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- Steel & Radiation Ltd.
- Trussed Concrete Steel Co.
- Turner, C. A. P.

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- H. R. Heinicke Inc

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- Equipment & Supplies, Limited.

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- Asphalt & Supply Co.
- Barber Asphalt Paving Co.

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- Dore & Fils
- Exeter Mfg. Co., Ltd.
- General Car & Mach. Works
- Jenckes Machine Company
- Lecky & Collis
- Morrison & Co., T. A.
- Mussens Limited
- Waterous Engine Works Co.
- Western Wheeled Scraper Co.

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- Goodwin, Barsby & Company.
- Greening Wire Co., B.
- Jenckes Machine Company

Roof Glazing
- Hope & Sons, Henry.

Roofing Material
- Asbestos Mfg. Company
- Barber Asphalt Paving Co.
- Bird & Son
- Can. H. W. Johns-Manville Co.
- Can. Supply & Contracting Co.
- Metallic Roofing Company
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- Sand and Supplies Limited
- York Sand and Gravel Co.

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- Goodwin, Barsby & Company.
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- Weller Mfg. Co.

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- Canada Iron Corporation
- Canadian Sewer Pipe Co.
- Dominion Sewer Pipe Co.
- Gartshore Thomson Pipe Co.
- Hamilton & Toronto Sewer Pipe Co.
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- Nova Scotia Clay Works Ltd.
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- Ontario Sewer Pipe Co.
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- Standard Clay Products Ltd.

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- Lecky & Collis

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- Pittsburgh Valve, Foundry and Construction Company
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- Gray Mfg. & Machine Co.

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Steam Turbines
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- Canadian Allis-Chalmers, Ltd.
- McDougall Caledonian Iron Wks.
- Sturtevant Co. of Can. Ltd. B. F.

Steel Bars
- Dominion Iron & Steel Co.
- Steel & Radiation, Ltd.

Steel
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- Can. Billings & Spencer
- Lecky & Collis

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- Gerald Lomer, Limited
- Mannesmann Tube Company.
- Page-Hersey Iron Tube & Lead Co., Ltd.
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Steel Tubes
- Mannesmann Tube Co.

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Stains, Shingle, Cement & Brick
- Cabot, Inc., Samuel

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- McGregor & McIntyre

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- Electric Steel & Metals Co.

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- Hope & Sons, Henry.

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- Drury Company, H. A.

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- Ontario Lime Co., Ltd.
- Parsons Company, G. W.
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- Rogers Supply Company
- Sackville Freestone Company
- Sand & Supplies
- Smyth & Ryan

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- Anderson, Geo.

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- Zouri Drawn Metals Co.

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- Burlington Steel Company
- Canadian Allis-Chalmers, Ltd.
- Chicago Bridge & Iron Works
- DesMoines Bridge & Iron Co.
- Dominion Bridge Company
- Drury Company, H. A.
- Hamilton Bridge Works Co.
- Mackinnon Holmes & Co.
- Manitoba Bridge & Iron Works
- Maritime Bridge Company
- McGregor & McIntyre
- Pittsburgh-DesMoines Steel Co.
- Reid & Brown
- Sarnia Bridge Company
- Structural Steel Company
- Standard Steel Construction Co.
- Toronto Structural Steel Co.
- Walsh Plate & Structural Works

Submarine Drills
- Lecky & Collis

Swinging Gears
- Dake Engine Company

Tanks and Stand Pipes
- Chicago Bridge & Iron Works
- Hamilton Mfg. Co., Wm.
- Inglis, John
- Jenckes Machine Co.
- Manitoba Bridge & Iron Works.
- Marsh & Henthorn
- McDougall Caledonian Iron Wks.
- Ontario Wind Eng. & Pump Co.
- Piggott & Co., Thos.
- Pittsburgh-DesMoines Steel Co.
- Vancouver Wood Pipe & Tank Company.
- Walsh Plate and Structural Wks.
- Waterous Engine Works Co.

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- Northwestern Terra Cotta Co.

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- Hunt & Co., Robt. W.

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- Sutcliffe, Speakman & Co.

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- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

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- Mannesmann Tube. Co.

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- Standard Tube & Fence Co.

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- Canadian Billings & Spencer, Ltd.

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- Canadian Allis-Chalmers, Ltd.
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Golden Anderson Valve Co.
- Kerr Engine Company
- Pittsburgh Valve, Foundry & Construction Company

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- Canadian Buffalo Forge Co.
- Canadian Sirocco Company
- Sheldons Limited
- Sturtevant Co. of Can. Ltd. B. F.
- Wilson, Limited, John T.

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- Tuec Company

Varnish
- Dougall Varnish Co.

Varnishes—Insulating
- Standard Underground Cable Co. of Canada, Ltd.

Wall and Joist Hangers
- Taylor Forbes Company

Wall Board
- Bird & Son

Waterproofing
- Cabot Inc., Samuel
- Can. H. W. Johns-Manville Co.
- Can. Supply & Contracting Co.
- Ceresit Waterproofing Co.
- Wadsworth Howland & Co., Inc.

Water Level Apparatus
- Gent & Company

Water Softeners and Filters
- American Water Softener Co.
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We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested:

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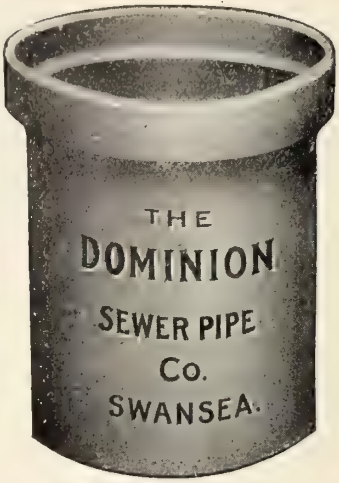

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April 1st	1½ cu. yd	490	612
April 2nd	1½ cu. yd.	595	744
April 3rd	1½ cu. yd.	550	687
April 4th	1½ cu. yd.	575	719
April 6th	1½ cu. yd.	375	469
April 7th	1½ cu. yd.	500	625
April 8th	1½ cu. yd.	175	219
April 9th	1½ cu. yd.	520	650
April 10th	1½ cu. yd.	370	462
April 11th	1½ cu. yd.	640	800
April 13th	1½ cu. yd.	556	695
April 14th	1½ cu. yd.	495	619
April 15th	1½ cu. yd.	393	491
April 17th	1½ cu. yd.	714	892
April 18th	1½ cu. yd.	560	700
April 20th	1½ cu. yd.	275	344
April 21st	1½ cu. yd.	510	637
April 22nd	1½ cu. yd.	525	656
April 23rd	1½ cu. yd.	555	693
April 24th	1½ cu. yd.	525	656
April 28th	1½ cu. yd.	165	206
April 29th	1½ cu. yd.	215	269
April 30th	1½ cu. yd.	350	437
Total 23 days		10,628	13,282
Average per 10-hour day		462	578

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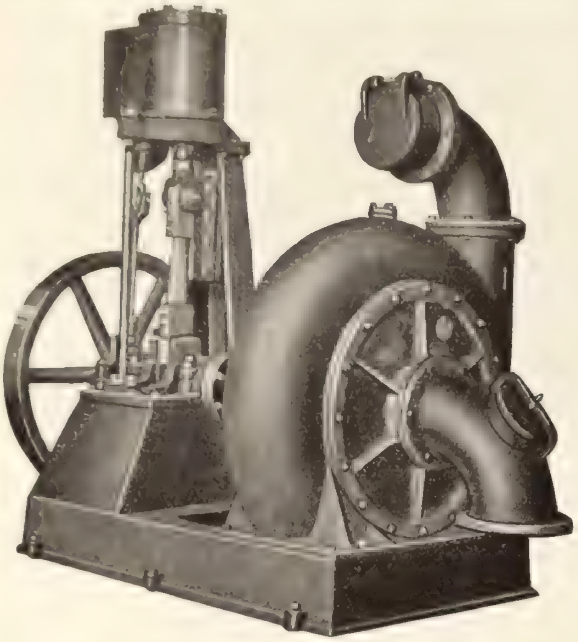

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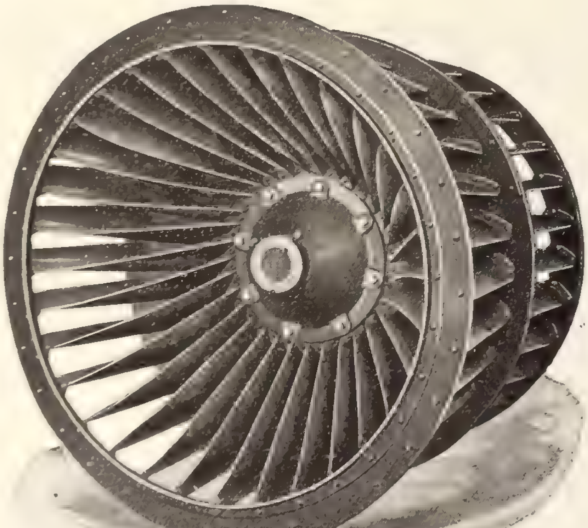

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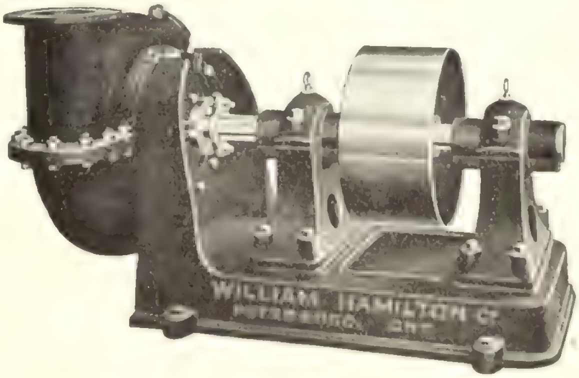

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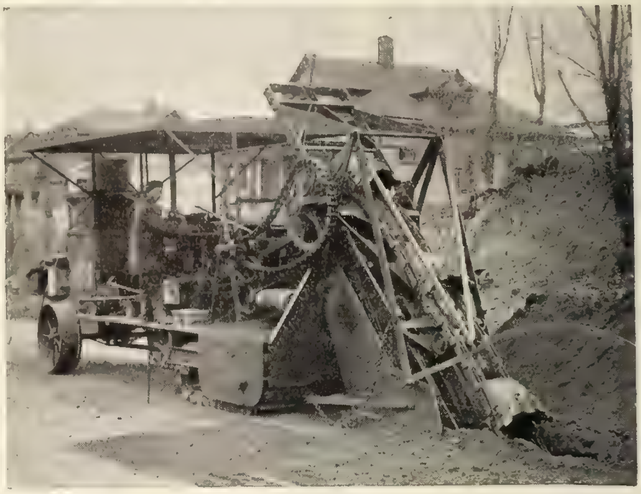

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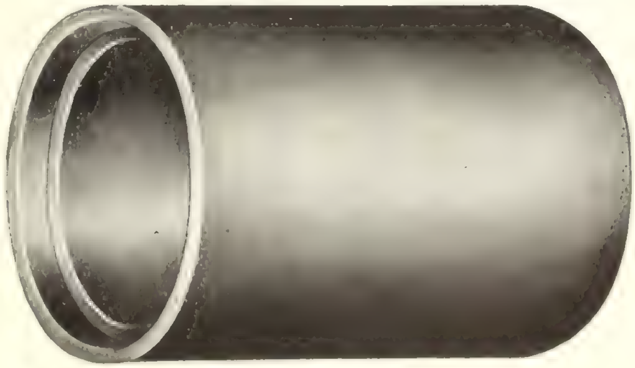

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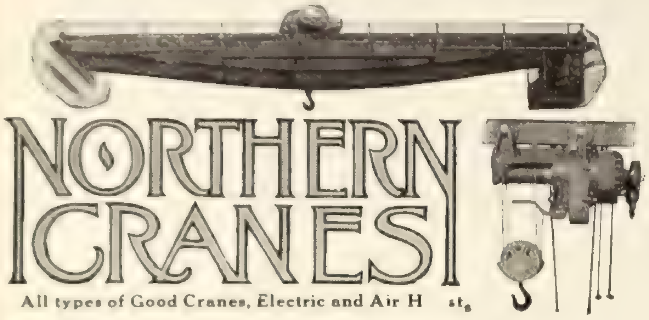

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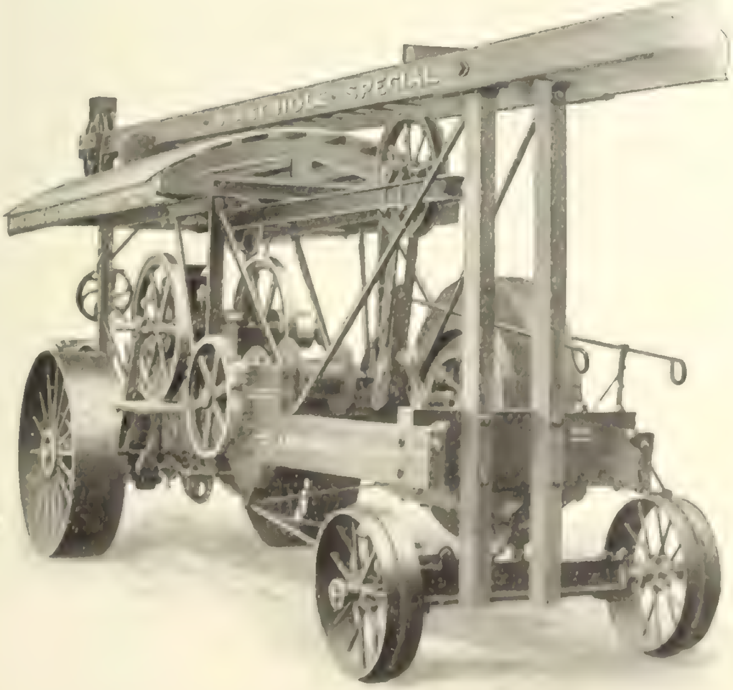

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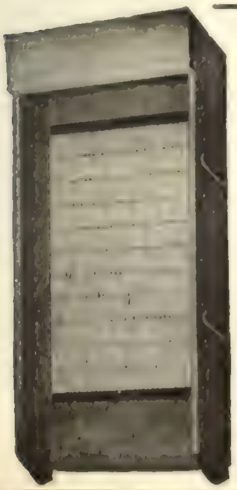

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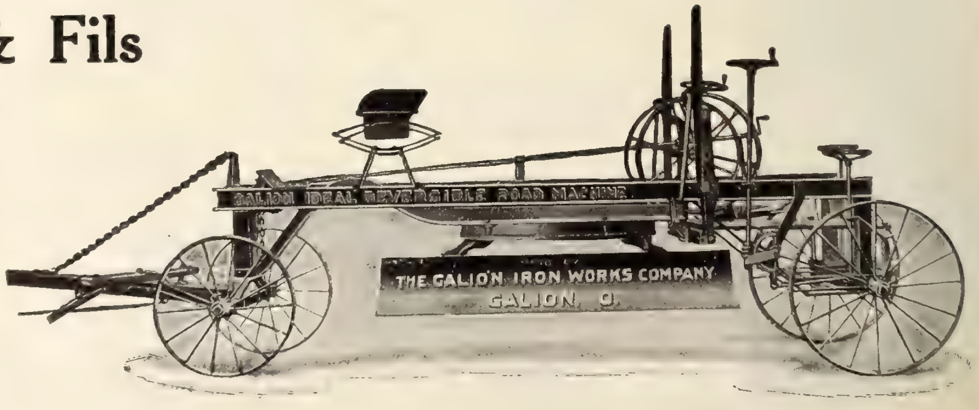
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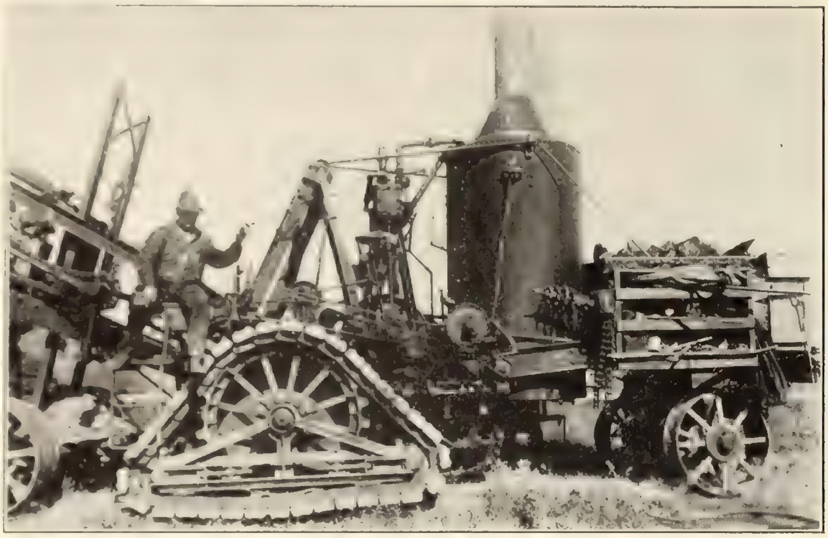

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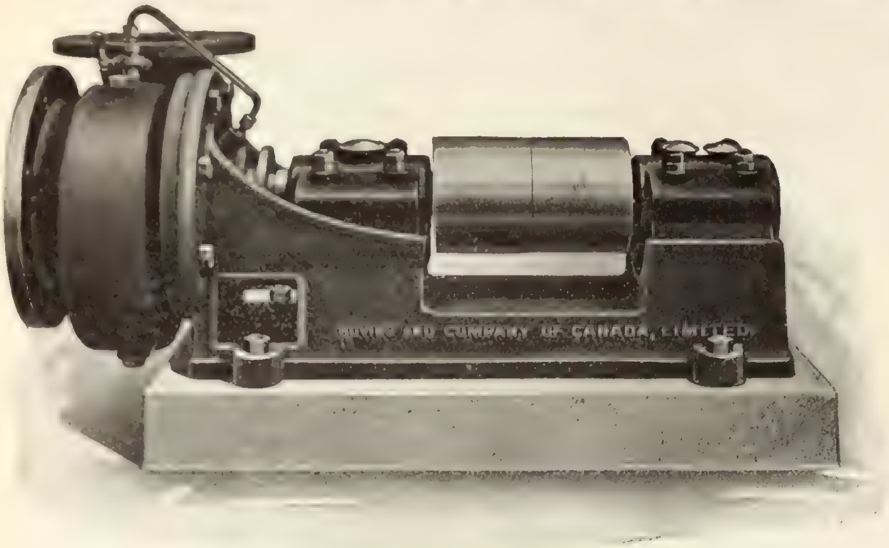

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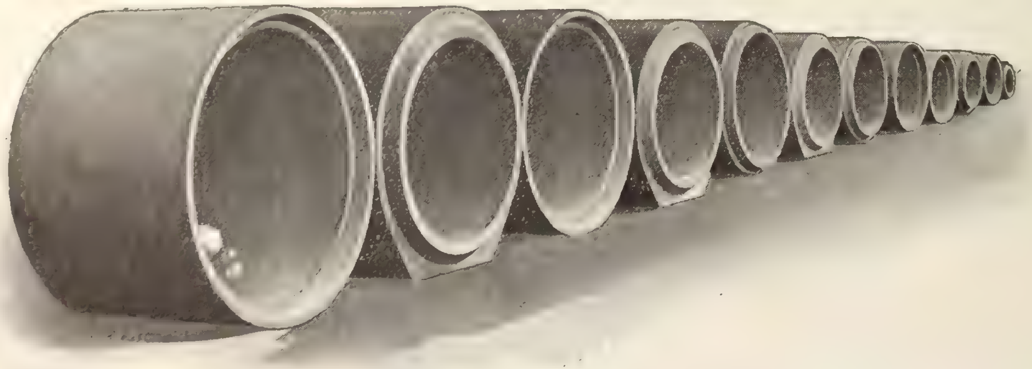

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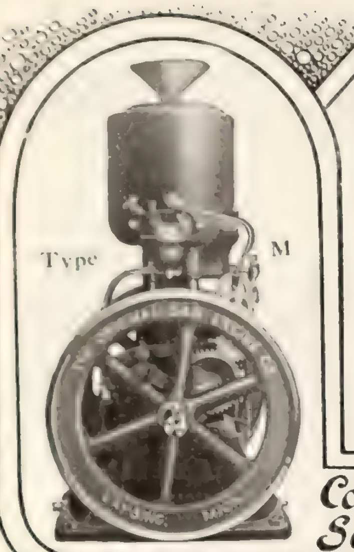

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For contractors' uses, Ideal Hoists and Pumps

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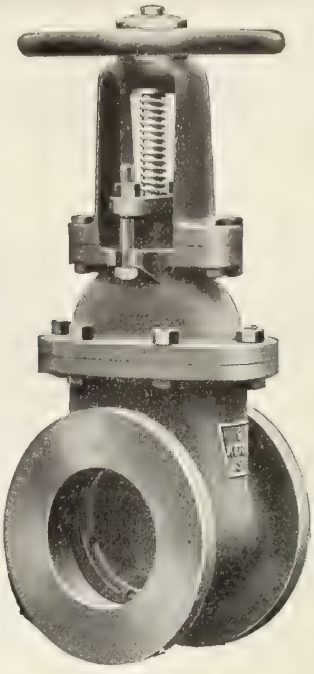

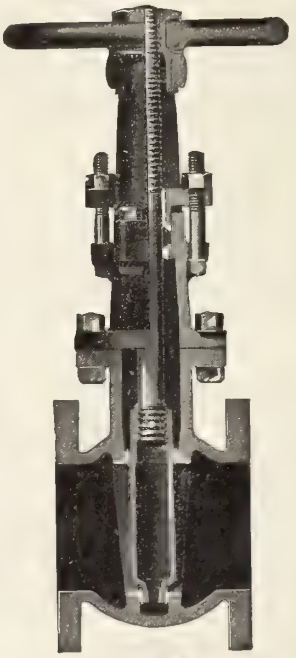

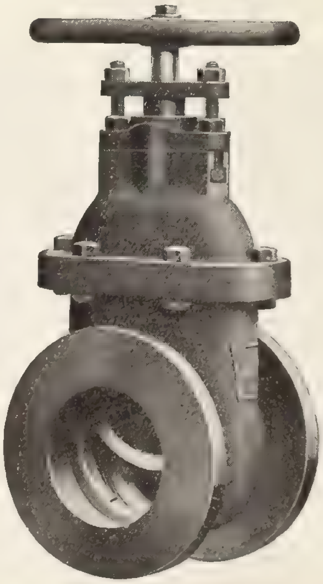

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are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

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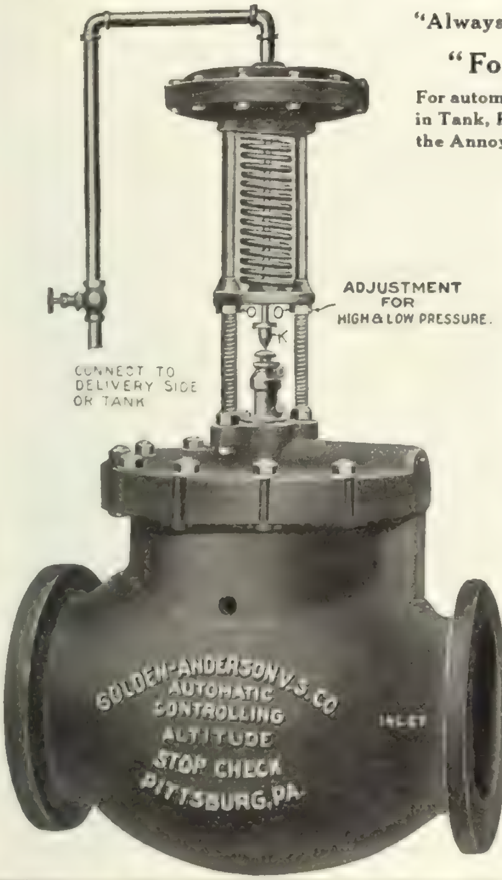
"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.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CONNECT TO DELIVERY SIDE OR TANK
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STOP CHECK
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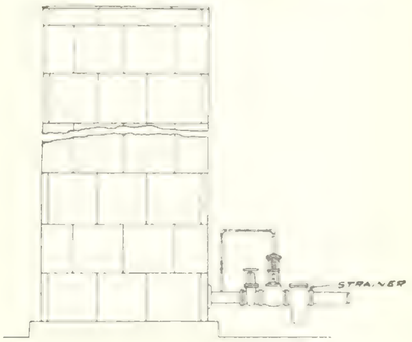

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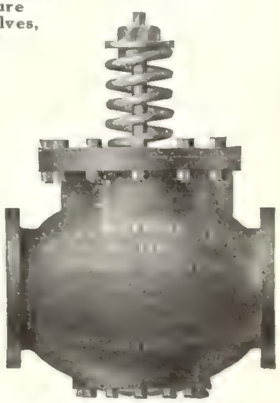

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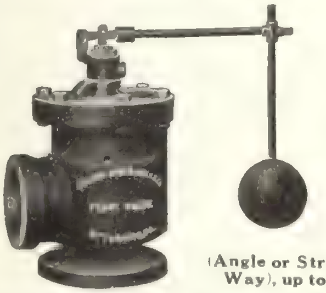

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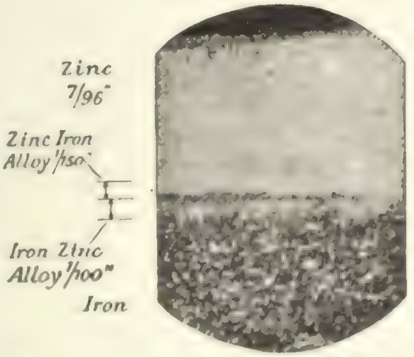

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is protected by a coating which is so firmly bonded to the steel that the surface of contact between the steel and the zinc disappears. Instead there is an intervening layer, made up of zinc-iron alloy in varying proportions. Metallurgists tell us that this is the condition for ideal protection. Practical men appreciate a coating that cannot possibly chip off.

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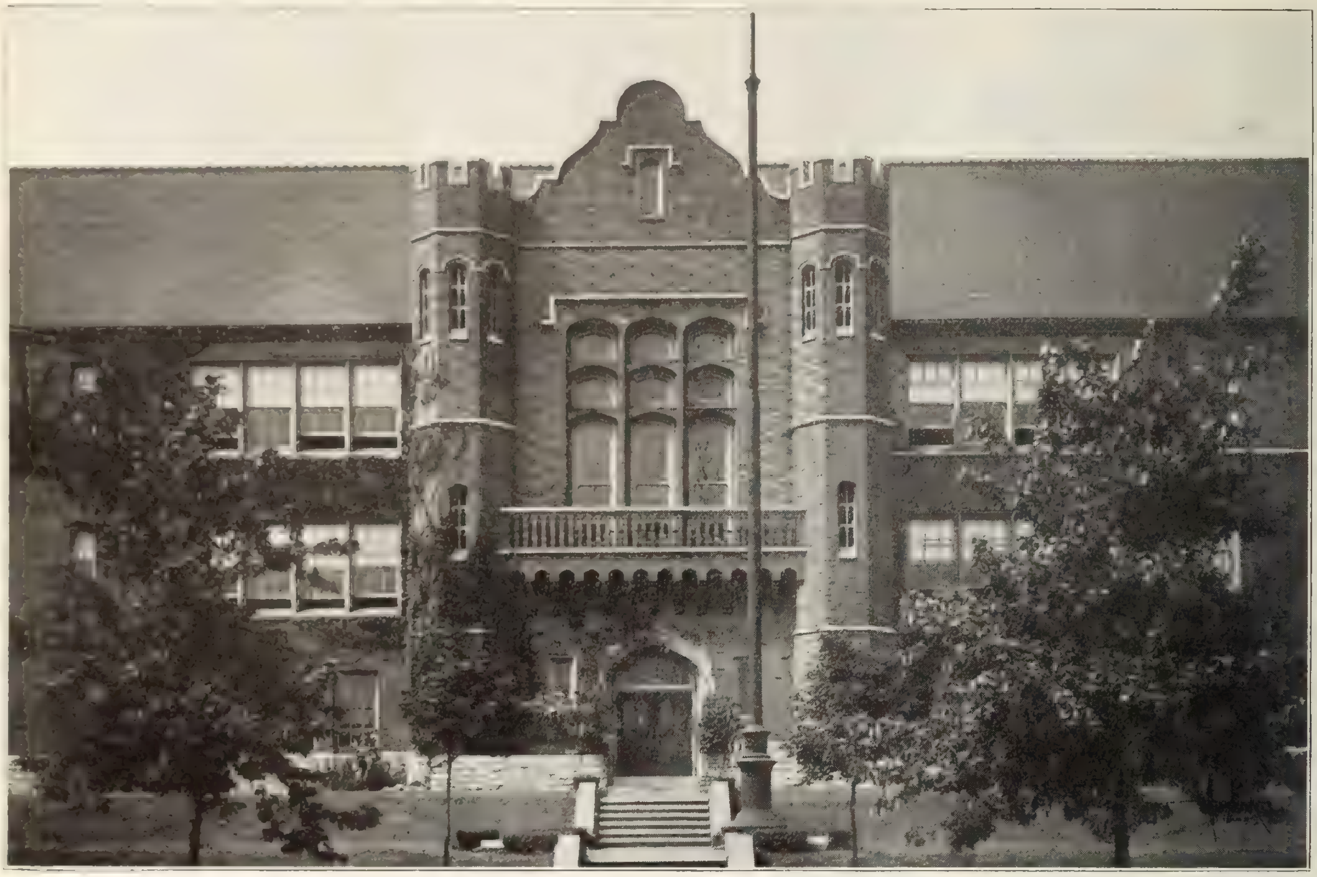

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WM. B. ITTNER, Architect

The brick used in facing this building is

Hy-tex

The Standard of Quality in Brick

—Hy-tex No. 100, kiln run, with black headers to accentuate the pattern work.

No matter what your requirements on any particular job may be, somewhere in the Hy-tex line you will find just the brick you want.

For information regarding Hy-tex Brick see specification data for 1914 or write us.

We have just issued a booklet, **"Bonds and Mortars in the Wall of Brick,"** an essay on design in patterns for brickwork. Copies of this booklet will be sent free to architects asking for it.

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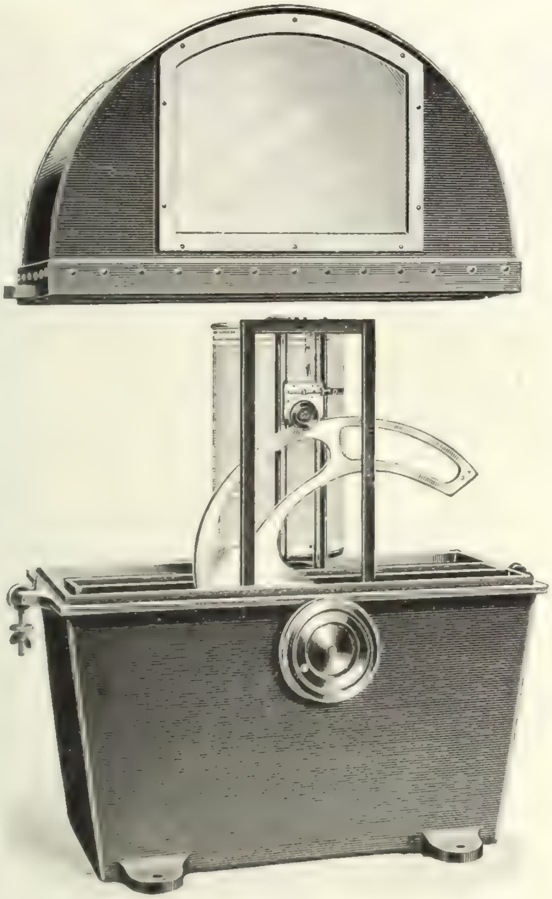

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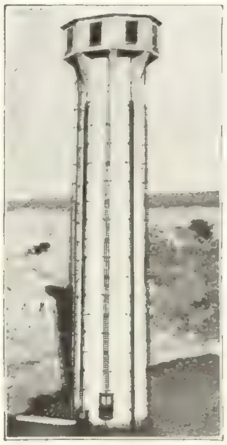

Concrete water tower at San Acacio, Colorado 135 feet high. Walls 3 ft. thick and waterproofed thoroughly by the use of Ceresit. Designed by W. D. Waltman, C.E., and built by General Concrete Construction Co., Chicago.

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Is the Simplest and Surest Thing Immaginable when you use

CERESIT

TRADE MARK

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After drying and setting the concrete or mortar will be thoroughly waterproof—neither dampness nor water under pressure can penetrate it.

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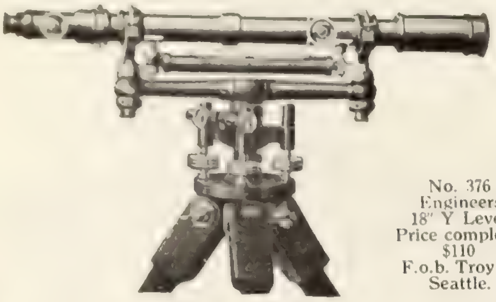

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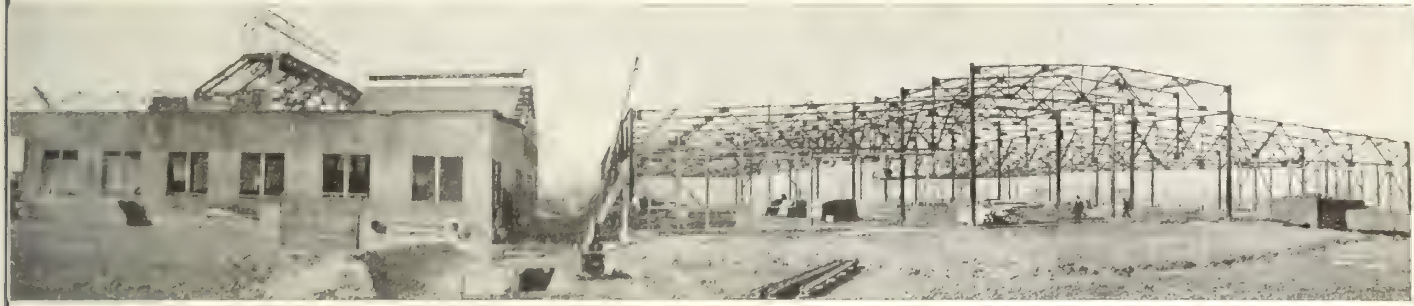

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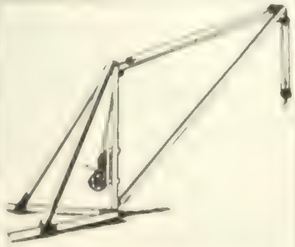

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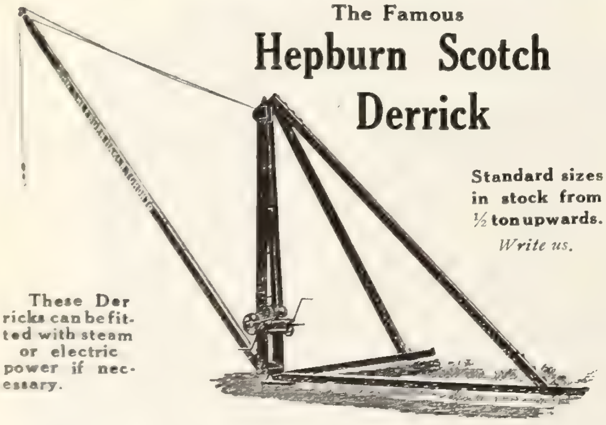

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ESTABLISHED 1886

Contract Record and Engineering Review

Published Each Wednesday By
HUGH C. MacLEAN, LIMITED
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - Tribune Building
CHICAGO - Tel. Central 6403 - 1155 Peoples Gas Building
LONDON, ENG. - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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The American Association of Portland Cement Manufacturers have decided to hold their convention in Montreal next September. Mr. F. P. Jones, General Manager of the Canada Cement Company, who attended a recent meeting of the Association at Philadelphia, states that the cement industry on the other side of the border has suffered little from the business depression. Cement road work is making great headway and over 5,000,000 bbls. of cement will go into country roads throughout the United States this season. Speaking of Canadian conditions, Mr. Jones states that the demand for cement in this country has been well maintained and that the sales last month were on a par with those of May, 1913.

The Functions of the Engineering Society

THE Engineering Society as an Influence in Education was the subject of an address by Mr. Albert Reichmann before the Western Society of Engineers, and the observations put forward offer plenty of scope for editorial discussion. As Mr. Reichmann pointed out, the training that an engineer receives at a university is so broad that to a limited degree it enables him to commence the practice of almost any branch of his profession. But so very broad is the field of engineering and so keen the competition in every line that in order to excel an engineer must choose a comparatively narrow field of activity in order that he may become thoroughly proficient therein. The progress of the world is so rapid, the field of human achievement so complicated that a man must be unusually able to anywhere near keep step with the onward march of events.

An engineer, therefore, must specialize along certain lines if he hopes to attain success; he must not only give the best that is in him to his immediate calling, but he must also study and observe the relation of his work to that of the other lines which have a bearing thereon. For instance: the expert in the construction and maintenance of railroad track should not only master the subject of track construction, but he must also watch the developments that are taking place in the motors and the rolling stock which pass over the road.

We have a notable example of this in connection with the development of the steam engine. After it was generally believed that this machine had attained its maximum efficiency it was found that it was not suitable for generating electricity, and as a result the steam turbine was evolved.

It is very evident, therefore, that an engineer in order to be successful cannot be a recluse. He must associate with his fellow engineers. Now he can best secure such association through the technical societies. The meeting of engineers under conditions where all are on a common footing fosters a spirit of kindly co-operation and helpfulness which binds them together and makes each of greater usefulness to the other. It is only by wide co-operation that the best advancement can be made in engineering science and achievement.

As in the legal profession the decisions of the judges are entered and published, thus forming a basis of precedent for future use, so also it is desirable that records of important engineering work should be published in order that we may benefit by the experience of others. Many of the larger engineering undertakings are the result of the co-operation of several engineers who are proficient in their respective fields. It is, of course, customary to have a chief engineer at the head of any important enterprise, nevertheless the work which he supervises is usually the product not of himself alone but of those also who are associated with him. It frequently happens that on large undertakings experts in various lines of the work are employed and the duty of the chief then consists in determining the general scope of the work, the special features being developed by these experts in their respective lines. For instance: the building of a large steel plant requires expert metallurgical engineers, electrical engineers, mechanical engineers and structural engineers. It is manifest then that as the work becomes of great magnitude, it is most important that accurate records of the same should be made available. These records can best be promulgated through the proceedings of technical societies. Such published proceedings find their way around the world.

Technical societies also afford the younger engineers the opportunity of securing the experiences of older engineers, resulting from the fact that they are permitted to participate on an even footing in the discussion of the papers presented.

The older engineers should and generally do take great interest in the work of the student engineers, and the latter may be greatly profited thereby.

The influence of the technical society and its value to the professional engineer is probably even greater than to the student. The practicing engineer is no longer under the guidance of professors and instructors and his opinions and development of ideas must be largely molded by those with whom he associates.

To be well educated involves not merely the mastery of knowledge, statistics and current events, but also embodies the broadmindedness which can see the justice and good sense of the other fellow's opinions and beliefs. A comprehensive judgment of various views and solutions is only possible through the assimilation of ideas and associations such as an engineering society offers.

In the technical societies the various steps of mechanical development are depicted both from the practical and theoretical standpoint. They afford the engineer an opportunity to supplement his own knowledge by the experience of his fellow engineers. They afford him the opportunity to present to the world what he himself has accomplished and to receive criticisms and suggestions from his fellow men. Resulting from the discussion of the various subjects which are presented the engineer learns to appreciate the benefits of co-operation, by means of which both the giver and receiver are greatly benefitted.

Engineering Topics in the Old Land

Conservatism in Great Britain and its Effect in Retarding the Progress of Sound Municipal Improvement

By the London, Eng., Correspondent of the Contract Record and Engineering Review

THE difference between conservatism and conservation is not perhaps at once apparent. Both words have the same derivation, and preservation is their elementary meaning; but there is a very distinct difference between them—a difference which it is important to note. Conservatism is defined in the dictionaries as "the being conservative of what is established," conservation as "the keeping of a thing in a safe or entire state," and it is at once clear that while the latter is a good attribute the former is but little removed from a bad one. The word conservatism should have no place in an engineer's vocabulary. An engineer must have no concern with what is established merely because it is established. Disestablishment is more in his line, for his work is essentially to see that things are kept in a safe and entire state. Whoso would be a man must be a nonconformist, says Emerson, and the greatest engineering creations of the world have been the work of the nonconformer, the man in whose ears the old shibboleths rang false and who was unafraid in the face of criticism and opposition. The recent plethora of papers and articles on concrete road construction must be held responsible for this somewhat lame preamble, but among the many ways in which the English engineer exhibits his conservatism there is none so patent as his unreasoning opposition to this form of carriageway. Scratch away the cuticle of an engineer, it may be said, and the "cutis vera" will not be reached until a more or less tough layer of conservative sub-integument has been removed. Some such layer is undoubtedly necessary—if only as a depository for first principles, formulae, axioms, fundamental truths and so on—but the more absorptive and porous it is the better for the individual, and, incidentally, for his clients.

Concrete Roads

Concrete carriageways are practically non-existent in England; anyway the writer has never seen one. Mention such a form of construction to the municipal engineer and he will probably say: "Oh, they're no good." Ask him if he has had any experience of them, if in fact he has ever seen one, and he will reply: "No, and I don't want to." Pursue the matter, and explain to him that quite civilized communities in the western hemisphere hold them in high estimation and use them largely, and he will close the argument with a disparaging remark about American practice and "we don't want that kind of thing here. It may be all right for them"—the final word embracing in a comprehensive sneer the whole of the peoples of the United States and Canada. In a recent paper delivered before the Canadian Society of Civil Engineers, certain advantages of concrete roads were set forth. It was claimed for them that they were low in first cost, averaging only about 10 per cent. more than waterbound macadam, that they were easily and cheaply maintained, that they were dustless and sanitary, and that they afforded good foothold for horses and due grip for motor vehicles. The English municipal engineer will have none of it. No Canada roads for him —no, not even the humblest thoroughfares! He is adamant, and, it must be confessed, not a trifle idiotic.

Brick Roads

Having never seen a concrete carriageway, the writer is quite as open to conviction that any such construction must prove a failure as that it has proved a success. Mr. Logan Waller Page confessed (in a paper read before the Association of American Portland Cement Manufacturers, of all people!) that he had "never yet seen a road built of Portland cement concrete that he considered altogether a success." This was in 1910, and Mr. Page may have changed (or at least modified) his views since then; but the fact remains none the less that Mr. Page had had experience of concrete roads and was qualified to speak upon them. Brick carriageway pavements lie under practically the same ban in England, but with more reason, inasmuch as they have been tried and found wanting. Their maintenance expenses are high and they are said to be execrable for the cyclist, while the heavy motor vehicle with iron-tyred wheels, or even the lumbering steam roller (despite its spreading of weight), may prove "so destructive as to crush (or at least severely damage) every brick in its track." Still, there are many miles of brick carriageways in existence which admirably answer the purpose for which they were laid, and there is scope now in England for the conduct of a series of real, live experiments. Bricks are used largely for crossings and channels in macadamized roadways, and the writer's experience of those laid for these purposes has been particularly happy. Leaving aside the question of brick carriageways, however, there can surely be no earthly reason—save unreason—why concrete carriageways should not be accorded a fair, full and extended trial. Failure is to be courted almost as much as success, if only for the setting to rest of a constantly recurring problem, and failure is even to be courted for its own sake as the bed-rock of experience.

Reinforced Concrete

Reinforced concrete has afforded another field for the display of British conservatism, and it was scarcely an edifying experience to witness the delight with which the engineering forces welcomed the inevitable failures in the earlier days of this form of construction. It was regarded as a craze, a temporary innovation, a red herring across the true and only road to constructional perfection. But, as has been the case almost throughout the history of the world, commercial interests predominated, and not commercial interests alone, but (shadow of the Union Jack) interests which must be qualified by the expression "foreign." The English engineer did not take it lying down. He was very much on the alert, but he carefully blindfolded himself and stuffed his ears, and his protest lacked force. Government departments were for many years his mainstay, fighting his battle (against foreign foes) tooth and nail, by-law and regulation. Even when certain departments had been won over and were themselves using the material—their officials having at last managed to grasp the principles of construction—outsiders were practically prohibited from doing so. But foreign persistence conquered in the end; and the time is not far distant when by-laws throughout the country will contain clauses more or less prohibitory. Such an expression certainly sounds somewhat of an anomaly, but in conservative communities prohibition is synonymous with qualified acceptance, while the drawing up of impossible regulations marks the incipient stages of absolutely untrammelled freedom.

The Trade and Technical Paper

ONE of the most conspicuous developments in the increasing specialization of business is the rapid rise of trade and technical papers. Time was when these publications occupied the lowest rung of the publishing ladder, but now they have begun to climb.

The civil engineer of our grandfather's day was merely a surveyor and the contractor occupied a much lower plane. To-day the engineering profession has been split up into many specialties and the contractor plays a part of ever-increasing importance. This development has been followed by the growth of powerful engineering-contracting periodicals which may be said to be pioneers in the newer and better trade and technical journalism.

In the field of business there has been the same increasing demand for special knowledge. While reading and studying were once the avocations of a business man, they are now a necessary part of his day's routine. He has ceased to read merely for amusement or to increase his personal culture and has turned to the literature of trade.

Engineering-contracting has problems that demands an individual organ of discussion. In catering to this need the technical-trade paper will fill a high destiny and only such a journal as places editorial sincerity above all other considerations will survive.

Purification of Water by Ultra-Violet Rays[*]

FREEDOM from turbidity is one of the first requirements for a water which is to be sterilized by ultra-violet rays. When any suspended matter is interposed the basterieidal action cannot occur, for the microbe is in the shadow. In most cases it is necessary to filter the water before submitting it to the action of the lamps. As color in solution will absorb ultra-violet rays to a certain extent it is evidently better to free the water from coloring material before submitting it to the rays.

Sometimes water with little suspended matter may be more difficult to sterilize than water with far more suspended matter. Suspensions of purely mineral nature which do not enclose any microbes and to which few microbes are attached handicap the sterilization of the water very much less than suspended particles in similar water which are heavily covered with microbes and particularly so if microbes are enclosed in these particles, because it is then most likely that a very long and repeated exposure to the rays will be necessary to penetrate to the enclosed germ life. If the suspended matter is of smaller size than the germs, like colloidal clay, it acts more or less like color in solution, demanding simply some more illumination than clear water.

From the economical point of view the condition in which the water is submitted to the rays is evidently of the greatest importance for the ultra-violet ray sterilization system. Physically ideal water, or water without suspended matter, turbidity or color will need very little power in ultra-violet rays to become sterile.

Smaller installations are being equipped usually with paper pad filters. In large plants, naturally, the filter question is an engineering proposition, as is the question of choice between mechanical and slow sand filters. It seems that if the latter are chosen they can be speeded up to higher rates than is safe for biological filtration alone and still give a physically pure enough water for ultra-violet ray treatment. At the Luneville plant in France the water is filtered at three times the rate of biological filtration for that particular kind of water. In other plants the sand filters have been speeded up to 10,000,000 gal., 12,000,000 gal. per acre and we even tried with fair success 25,000,000 gal. per acre followed by ultra-violet ray treatment.

Operating Costs

Operating costs will vary with the size and the running hours of the plant and the coefficient of safety for the ultra-violet ray treatment. According to the quality of the water it is expected in large plants which run 24 hours that the current consumption will vary between 30 and 125 kw.hr. per million gallons, allowing for a large safety coefficient. The labor charges are negligible, as the apparatus only needs an occasional cleaning and starting of lamp. Apart from this the lamps have to be repaired from time to time. When the water is of variable physical quality one will have to establish the plant so that all the lamps will be running during the period of least transparent water and only some of them during the period of greatest transparency.

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[*] By Max Von Recklinghausen [illegible] R. U. V. Company, [illegible] New York.

If reliance is placed on chemicals to disinfect water, we must work close to and sometimes even over the limit of the amount which will not make itself objectionable by producing taste and odor in the water. There is an increasing opposition to the use of chemicals for the purification of water supplies. In the ultraviolet rays we have a system where we may choose our safety coefficient as high as we like. We may overdose our sterilization as much as we want without creating any objectionable features in the water, like taste and odor. The waterworks engineer has therefore in this system a much more satisfactory weapon against pollution than he ever had before.

Representative City Planning Conference Held at Toronto

THE Sixth National Conference on City Planning, the first of its kind ever held in Canada, was opened on Monday, May 25, in Convocation Hall, Toronto University, by His Royal Highness the Duke of Connaught. The congress, which concluded on May 27, was one of the most successful on record and the delegates, representing 74 cities and towns of Canada and the United States, of whom upwards of three hundred were in attendance including a number from Great Britain, will carry away with them many practical lessons relating to the scientific and architectural sides of city planning and city development. Exhibits showing plans for the improvement of many cities on this continent and abroad, as well as of the work which has already been accomplished in giving effect to these proposals, were conveniently arranged in the hall at the rear of Convocation Hall, and added immeasurably to the interest and value of the conference.

The Duke of Connaught, addressing the conference, paid a tribute to Toronto in stating that the energy, good taste and public spirit of its citizens had resulted in the construction of a beautiful, spacious city. He looked upon city planning as among the most pressing of the many problems confronting the public men of our cities in Canada to-day. Having alluded to the evils that resulted in European countries from the haphazard construction and planning of houses and streets, His Royal Highness emphasized that with such lessons before us it would be nothing short of a national disaster if a similar state of things were allowed to develop in Canada. The problem was one which admitted of no delay. He concluded by emphasizing the need for providing ample park and playground space, the creation of main arteries of communication in cities, and the securing of adequate housing conditions for an increasing urban population.

Hon. Geo. McAneny, President of the Board of Aldermen, New York City, in thanking his Royal Highness on behalf of the conference, said that the city planner of to-day was working out the great problems that had to do with the betterment of the social conditions of the people in cities. He congratulated the Duke of Connaught on the part played by the British nation, the inspiration for the work on the American continent having come from England. Speaking of the wild growth of many cities, he instanced the case of New York where they were spending millions to-day on connections which might have been foreseen.

After the opening ceremony the members were entertained at luncheon in the School of Science building, Toronto University, by the Ontario government. The delegates were welcomed by Dr. J. W. S. McCullough, Provincial Officer of Health, and Mr. Nelson B. Lewis, Chief Engineer of the Board of Estimates and Apportionment, New York, suitably replied.

The business sessions of the convention were opened at 2.30 p.m., Hon. Geo. McAneny, President Board of Aldermen, New York City, presiding. The delegates were formally welcomed by Hon. Clifford Sifton, chairman of the Conservation Commission of Canada, who reviewed the growth of the city planning idea. Canada had paid little attention to the problem of building for the future, and it was only about three years ago that a general awakening had been witnessed and a practical effort made to cope with the conditions which had grown up through neglect. Various organizations had set themselves to the solution of the difficulty. The Toronto Harbor Board had an important scheme that no doubt would afford much relief in the future. He emphasized the necessity of a comprehensive town planning act for the Dominion. Rational city planning would do much to cure their present unsatisfactory conditions, and the real problem which faced the intellect of the twentieth century was whether we are big enough to grapple with present evils. Mr. Frederick L. Olmstead, chairman of the executive committee, replied, after which the greetings of the British Town Planning Institute were conveyed by Mr. Thos. Adams, London, Eng.

Mr. Robt. S. Gourlay, Toronto Harbor Commission, gave an address on "Basic Principles of Waterfront Development as Illustrated by the Plans of the Toronto Harbor Commissioners." He referred to the projected deep waterway scheme for Toronto and the proposal to reclaim the marsh lands and make them productive by turning them into factory sites. The paper gave rise to much discussion, taken part in by representatives of Harbor Commissions of Canada and the United States.

The evening session was opened at 8 p.m. with an address on "Certain Aspects of Municipal Financing and City Planning," by Mr. Andrew W. Crawford, of Philadelphia, who spoke upon certain aspects of the subject and laid down the principle that no municipality should issue bonds unless the object were reasonably adequate for the subsequent needs of the community.

The subject of "British Loans in Canada" was introduced by Mr. G. Trafford Hewitt, London, Eng., who alluded to the lack of control over municipal expenditure in Canada, and expressed the opinion that the Dominion required a board equivalent to the Local Government Board of Great Britain, to administer the municipal financial affairs in order that confidence might be re-established in Canadian investments. Hon. Geo. Langley, Minister of Municipal Affairs for Saskatchewan, pointed out that such a board was actually in existence in Saskatchewan.

Mr. G. T. Hewitt addressed the conference on "Canada as a Field for the Garden City Movement," describing the different types of garden cities in England, and lauding the enterprise in that direction which is being commenced in Nova Scotia, the first organization of its kind in Canada.

Tuesday's Sitting

The third conference session was opened at 10 a.m. on Tuesday in a paper delivered by Mr. Lawrence Veiller, Secretary and Director of the National Housing Association of New York, who declared that Canada was five years ahead of the United States in controlling residential districts and in the types of buildings erected in certain areas. The first step along this line was taken in the United States in 1909, when Los Angeles passed an ordinance prohibiting objectionable industries in certain parts of the city, but the movement had already been under way for five years in Canada, under the authority of the Ontario legislature. Those taking part in the discussion included Mr. Alfred Bettman, Cincinnati, and Mr. Frank B. Williams, of New York. Mr. Williams said that in the administration of cities principles must as a general rule be applied, not to the construction of a new city but to the development of an old one.

The session concluded at noon and the members, having been photographed, journeyed to the waterfront, where they were entertained at luncheon by the Harbor Commissioners.

Canadian Town Planning

The evening session was resumed by Dr. Charles Hodgetts, Medical Advisor to the Conservation Commission of Canada, who presented the draft of a Canadian Town Planning Act for discussion. The draft bill provides that the act shall be administered under a Department of Municipal Affairs by a town-planning board consisting of a controller, who shall be the permanent paid executive official, skilled in town-planning, and chairman of the board. Every municipal authority is empowered under the act to erect a local housing and town-planning board, and to appoint a housing and town-planning commissioner who shall be the executive officer of the local board.

During an interesting discussion which followed, criticism was offered to the scheme, mainly on the ground of possible friction occurring between local boards and city councils.

Wednesday's Session

The concluding day was taken up with a discussion of rapid transit and transportation questions, initiated by Mr. J. V. Davies, consulting engineer, Brooklyn Rapid Transit Company, whose theme was "Provision for future rapid transit: subway, elevated or open cut, and their influence on city planning." The essential for rapid transit was the radial street running outward from the commercial centre, unless the traffic was placed underground. Comparing the costs of various systems of rapid transit, based upon the cost of trolley service in open country, he said that for every $25,000 spent on such a simple system the trolleys and streets cost twice as much; underground trolleys and streets twice to five times as much; elevated railroads, five times as much; open-cut railways, nine to ten times as much; masonry viaducts, twelve to thirteen times as much; subways in open country, sixteen times as much; subways in city streets, forty-seven times as much; and tube tunnels, one hundred times as much.

Mr. John A. McCollum, Assistant Engineer, Board of Estimate and Apportionment, New York City, said that the motor vehicle as a general transportation agent would surely be tried in this country. The two distinguishing characteristics of the motor 'bus advantage over other service transportation were—flexibility of movement, and flexibility of route. Mr. McAneny, New York, said that in New York they had added as a corrollary to the extension of their transit system the proper regulation of height of their buildings. Mr. Thos. Adams, London, Eng., an authority on town planning in Great Britain, said that transportation should be based on proper town planning. Mr. E. P. Goodrich, consulting engineer, New York City, expressed the opinion that the motor 'bus operated more rapidly than the trolley car, which was a material point in determining the kind of vehicle which should be operated.

The members of the conference were the guests of the city of Toronto at luncheon, a feature of which was three-minute talks by representatives of cities and city planning commissions of Canada and the United States.

At the afternoon session Mr. Henry V. Hubbard, Assistant Professor of Landscape Architecture, Harvard University, addressed the conference on the subject of playgrounds and recreation facilities in American cities. An interesting discussion followed, which was taken part in by Lt.-Col. Anderson, of Ottawa, Mr. Lawson, of Vancouver, and several others.

The appointment of the executive committee for 1914-15 took place in the afternoon, the members selected including the following: Dr. Chas. Hodgetts, Ottawa; Mr. J. P. Hynes, architect; Toronto; Mr. E. P. Goodrich, Consulting Engineer, Borough of Manhattan; Mr. Geo. S. Webster, Chief Engineer, Philadelphia; Mr. Edward H. Bennett, architect, Chicago; Mr. Geo. B. Ford, architect, New York City; and Mr. John Nolan, landscape architect, Cambridge, Mass. Messrs. S. Morley Wickett and A. J. Anderson, Toronto, are amongst those appointed on the General Committee.

Invitations for next year's conference were received from San Francisco, Cincinnati, Baltimore, and Detroit, and the matter of selection was referred to the Executive Committee.

Proposed National Municipal Association of Canada

The Canadian delegates met on Wednesday afternoon to discuss the advisability of forming a National Municipal Association of Canada. The idea met with general approval and a resolution was adopted requesting the Commission of Conservation to create a special Bureau of City Planning as a central body, to co-operate with provincial or other housing or town-planning organizations.

The Conference closed with a dinner on Wednesday night, at which the members were the guests of the Conservation Commission.

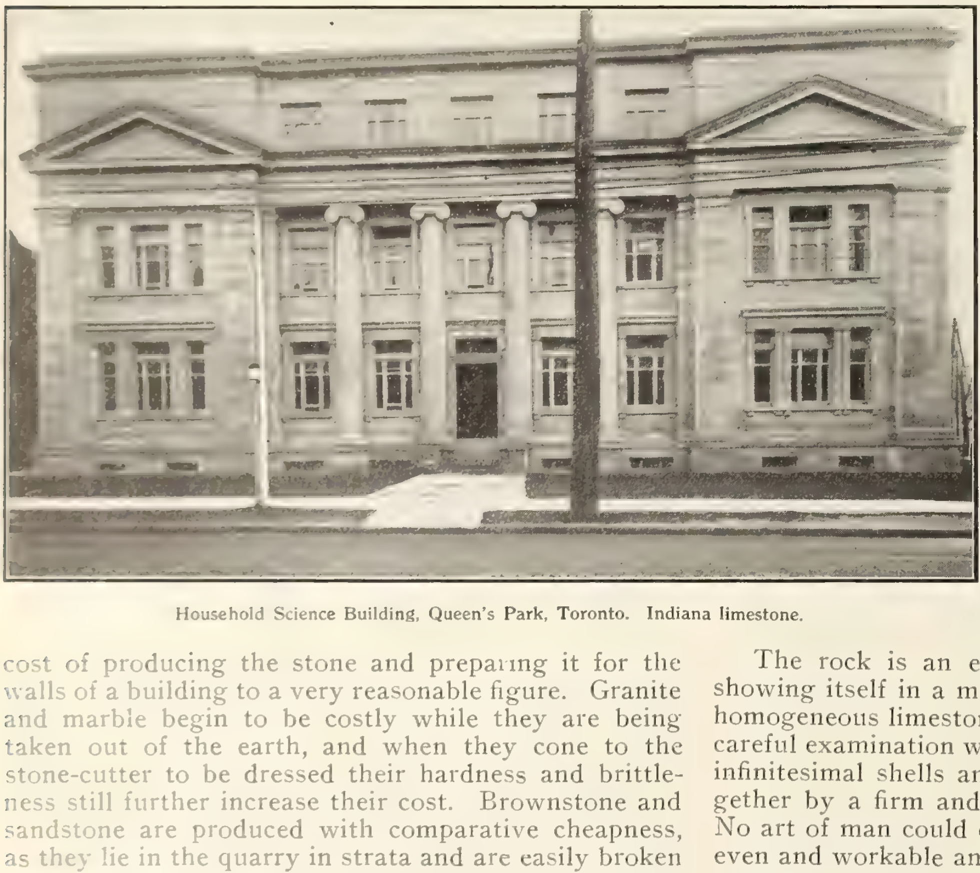
A contract for the erection of the new telephone building in Medicine Hat has been awarded to Messrs. [illegible], Leader & Goode of that city. An automatic telephone system will be installed.

The Nature and Utility of Building and Ornamental Stones

IN the following pages we illustrate a number of noteworthy Toronto buildings which stand as a monument to the enduring qualities of natural stone. The article has been prepared in compliance with requests for such data made from time to time and the material is abstracted from a brochure issued recently by the Journeymen Stonecutters' Association. It is hoped that the notes, as abstracted, will be found to embody helpful suggestions.

INDIANA LIMESTONE

The prominence which Indiana stone has achieved is due to the possession of three ideal qualities in a building stone—light, beautiful color; great strength and endurance; and adaptability to ornamental forms at small expense. The ease with which it is quarried and the facility and certainty with which the hewers and carvers can work out designs upon it, reduce the cost of producing the stone and preparing it for the walls of a building to a very reasonable figure. Granite and marble begin to be costly while they are being taken out of the earth, and when they cone to the stone-cutter to be dressed their hardness and brittleness still further increase their cost. Brownstone and sandstone are produced with comparative cheapness, as they lie in the quarry in strata and are easily broken out; but they are hard, brittle and difficult to carve, and the cost of cutting and dressing them, while not so great as granite and marble, is still very high. Oolitic limestone, on the contrary, is not an expensive material at any point from production to setting in the walls. It therefore enables the architect to carry out the most artistic designs as well in modest dwellings as in more pretentious buildings, such as churches, office and public buildings, the element of excessive cost being eliminated without sacrificing anything that is proper for useful and enduring construction. These qualities have rendered the stone universally popular, and the peculiar light and cheerful gray of Indiana stone has therefore become a marked feature of the churches, residences, office buildings and large structures of American cities.



Household Science Building, Queen's Park, Toronto. Indiana limestone.

Resemblance to Portland Stone

Indiana stone has not had the benefit of many years' trial to test its endurance, although some of it was used as early as 1850, and is still unimpaired. But oolitic limestone has been thoroughly tested elsewhere. The other great deposit of this stone was found in Portland, England, and was used entirely in the construction of Westminster Abbey, St. Paul's Cathedral, the old city wall of London, and many churches and buildings erected in the time of Queen Anne. Indiana stone and the Portland stone are of the same geological age and quality and are almost identical in composition. Indiana stone is the superior, however, owing to the lesser quantity of oxide of iron and magnesia which it contains and its consequent gain in being more nearly a pure carbonate of lime—a purity rarely, if ever, surpassed, and scarcely equalled in the world. Its superiority is further increased by the fact that it is more than fifty per cent. less porous than the Portland stone, the ratio being 1 in 20 for the latter against 1 in 42 for Indiana stone. Each of these stones possesses the excellent quality of never cracking or scaling, due to the fact that they are pure limestones and are not affected by gases existing in the air.

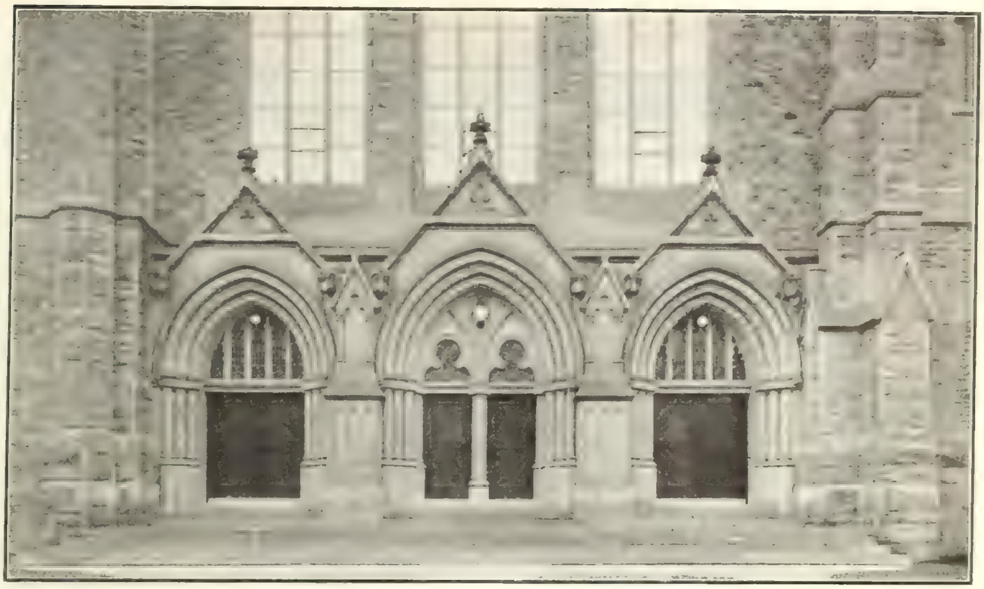
GEOLOGICAL REPORTS

The following extracts from the reports of independent scientific men, give briefly some information in regard to the geological character of the stone:

Report of Prof. M. Thompson, State Geologist of Indiana

The rock is an element of the St. Louis group, showing itself in a massive, evenly bedded stratum of homogeneous limestone of a whitish gray color. Upon careful examination with the glass its grain seems to be infinitesimal shells and shell fragments, all bound together by a firm and even setting of lime carbonate. No art of man could construct a mass at once so firm, even and workable and at the same time so elastic and strong. The stone comes from the quarry soft, tough and easily cut. In a short time it hardens, so that it rings with a musical note (like that of a steel bar) when struck with a hammer. A bar four feet in length and two inches square may be bent so as to deflect greatly, and when released will spring back to a right line with the promptness and energy of highly tempered steel. Upon being broken, the stone parts with a smooth direct fracture, showing a surprising evenness and continuity of texture, with no trace whatever of laminations, seams or changes of structure.

Geologically, the oolitic limestone is very interesting and its existence is by no means a problem easy of solution. The more it is studied, however, the more it appears to be the result of calcareous sediment deposited at the bottom of a deep trough in an otherwise shallow sea. The shells of which the greater portion of the rock is composed are, as a rule, much smaller than the smallest ordinary pinhead; indeed, barely distinguishable under the most favorable circumstances by the unaided eye. These minute shells are cemented together with a cement composed of fine fragment dust of other shells, and an intermediate setting of pure lime carbonate, which renders the whole mass perfectly homogeneous, elastic and resonant.



Knox Church, Spadina Avenue, Toronto. Indiana limestone.

Report of Prof. John Collett, State Geologist of Indiana

By far the most beautiful and valuable stone for architectural purposes is the oolitic limestone. The supply is simply inexhaustible, as it lies in massive strata of from twenty to seventy feet thick over a large area.

These strata are homogeneous, equally strong in vertical, diagonal or horizontal sections. The stone comes from the quarry so soft as to be readily worked by saw, chisel or planing machine, while on exposure it hardens to a strength of from 10,000 to 12,000 pounds to the square inch—a strength amply sufficient to sustain the weight of the largest structure in the world. It is of almost unprecedented purity, containing an average over the magnesian limestones, as it is not affected by decay in an atmosphere charged with the gases of burning stone coal. In natural outcrop it presents bold, perpendicular faces to the elements, showing every scratch and mark, unaffected after the exposure of thousands of years, as no other stone or rock does.

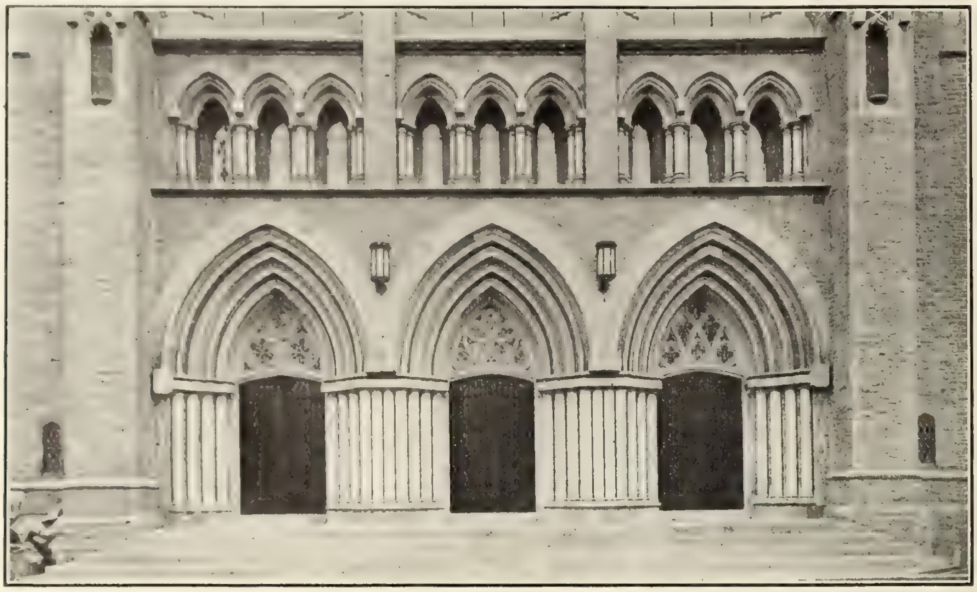
It is quarried by steam channelers, which carve it out in prisms of 6 x 10, 50 or 100 feet long, putting to shame the boasted prodigies of Egyptian story and effort. It is then rapidly sawed into blocks and dimension forms, and steam planers carve and mould it like clay or wood and more accurately than mallet and chisel. It is now fit to be carved into the finest kind of sculptured and ornamental forms.

Ready for the mason or sculptor, it is alive and resonant, answering with a clear metallic ring each touch or blow. This resonance is an excellent test of the perfect unity of its particles, and as a result it is highly elastic, bending under pressure and rebounding to place when relieved from it. This elasticity enables Indiana oolitic limestone to adapt itself without damage or disintegration to our changeable climate, where material will be frequently subject to a change of from twenty to sixty degrees of temperature in a few hours, as in large buildings the outside will be subject to a temperature of twenty-five degrees below zero in winter, or 120 degrees above in the summer, while the inside wall will remain at sixty or seventy degrees—a difference of fifty or eighty degrees in the extremities of the same stone—with their accompanying effects in expansion or contraction. The strains of heat and frost will tear down buildings and sides of mountains with their great expansive forces, and even steel and iron will give way before them. Here, then, is represented to the builder and architect a new and wonderful element in an elastic stone, a potent quality which when united with its other sterling excellences of strength and beauty, makes Indiana limestone the best in the world for exposed work in localities subject to great changes.

Crushing and Fire Tests

A test made by the United States Government gives the crushing strength of Indiana stone at about 135,000 pounds to the square foot. That this enables it to sustain an enormous weight is shown by the following table of maximum weights borne by the piers and ma-

Residence, Crescent Road, Toronto. Indiana limestone.



St. Paul's Church, Bloor Street East, Toronto. Indiana limestone.

sonry of well known structures: Piers of St. Peter's, Rome, 33,000 lbs. sq. ft.; piers of St. Paul's, London, 39,000 lbs. sq. ft.; piers of Brooklyn Bridge, 57,000 lbs. sq. ft.; granite masonry of Washington Monument, 45,000 lbs. sq. ft.; reliable sustaining weight Indiana Stone, 135,000 lbs. sq. ft.

Fire tests show conclusively that the oolitic stone is fireproof up to the point of calcination or turning into quicklime, in which respect it is superior to the average building stone, as far as shown by published tests. While a few building stones will withstand uninjured a temperature above the calcination point of lime, the greater number will be destroyed at a temperature below that point.

The Indiana Quarries Company, Indiana, recommend, in setting Indiana Stone, the use of a mortar made of one part lime and three parts sharp, clean sand, both for the stone and for the brick backing. It is not safe to use mortar for the stone and cement for the backing. Like granite and marble, Indiana stone is subject to stains from the penetrating acids in cement, and for that reason lime mortar should be used. These suggestions are based on the latest experience of builders who have used cement in connection with Indiana stone.

In the specifications for the city buildings in St. John's Park, New York, the architects, Messrs. Carrere & Hastings, instructed "All this material (Indiana stone) to be set in mortar of one part limeputty and three parts clean, sharp sand." Where the build-

Residence, Chestnut Park, Toronto. Indiana limestone.

Residence, Walmer Road, Toronto. Indiana Limestone.

ing laws do not compel the use of cement, it is believed that the most satisfactory method is to set both the stone and the brick backing in a mortar made in accordance with Carrere & Hastings' specifications given above.

Indiana stone is found in two colors—buff, or light gray, and blue. The buff is the more generally known and is produced in the greatest quantity. The blue comes from the bottom ledges and the amount in sight is always comparatively limited. It consequently takes a slightly higher price than the buff, but in all respects the two stones are of equal quality and texture. The "Hoosier light blue" is believed to be the most beautiful variety of the stone ever produced, fading on exposure to a soft, harmonious gray.

This particular stone lends itself admirably to the construction of public buildings, factories, warehouses and residences, and it can be obtained in any quantity and dimension. As well as being suitable for the purpose of expressing artistic design, it appeals to the business man because of its cheapness and durable construction.

OHIO SANDSTONE

The fitness of stone for structural purposes can be determined approximately by examining a fresh fracture. It should be bright, clean and sharp, without loose grains, and free from any dull, earthy appearance.

Tests of the strength of blocks of stone are useful only in comparing different stones, and give no idea of the strength of structures built of such stone, or of the crushing strength of stone in large masses on its natural bed. The crushing resistance per square inch of

Lieutenant Governor's New Residence at Rosedale, Toronto. Ohio sandstone.

Bank of Montreal, Yonge and Front Streets, Toronto. Ohio sandstone.

New Veterinary College, Toronto. Attractive use of Ohio sandstone.

The Nature and Utility of Building and Ornamental Stones

compressed surface increases approximately in the ratio of the cube roots of the sides of the respective cubes.

The durability of sandstone varies with both their physical and chemical composition. Great differences may exist in the durability of stones of the same kind, presenting little difference in appearance.

When nearly pure silica, and well cemented, sand stones are as resistant to weather as granite, and very much less affected by the action of fire. Taken as a whole, they may be regarded as among the most durable of building materials. When first taken from the quarry, being saturated with quarry water (a weak solution of silica), they are frequently very soft, but on exposure become harder by the precipitation of the soluble silica contained in them.

St. James' Cathedral, King Street East, Toronto. Ohio sandstone.

Doorway Central Building, University of Toronto Ohio sandstone

The stone derived from the Gray "Canyon" and Berea quarries is a member of the lower carboniferous series, and is the most valuable geological formation in this country. It is homogeneous in texture and composed of nearly pure silica. These stones are a light blue-grey color, very resistant to fire and weathering, and, on the whole, are the best and handsomest building stones known.

Decoration and Utility

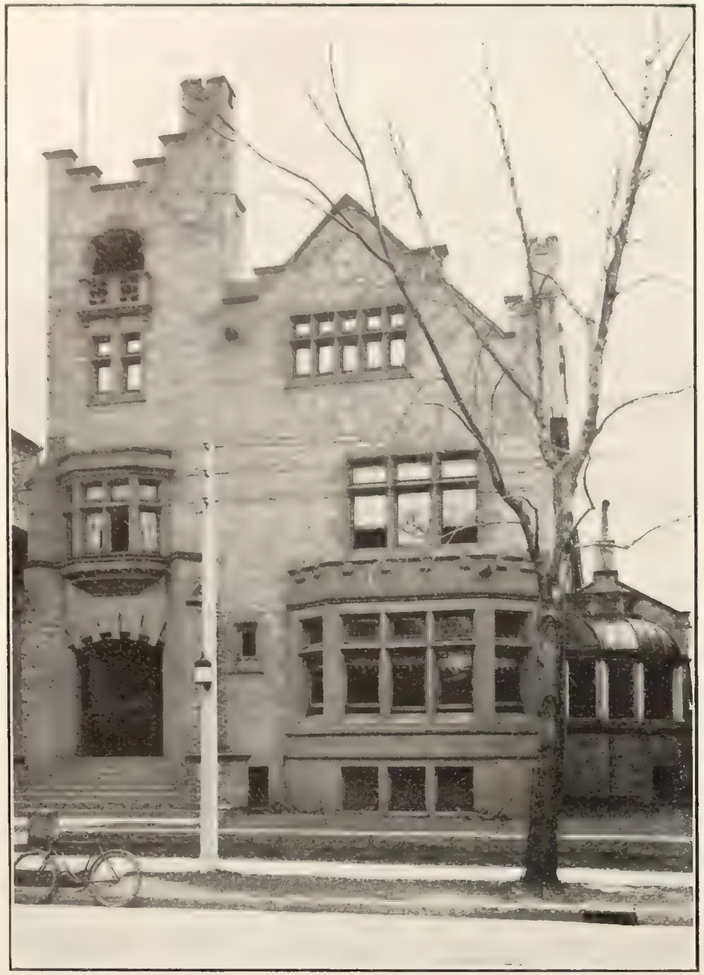
The utility and decorative value of the Ohio Sandstone has probably outrivalled any other sandstone as a suitable material for building construction. The firmness and homogeneous character of this stone render it exceedingly well adapted for ornamentation. The most elaborate design can be executed in the highest relief and retain its clean-cut outlines through generations of time and exposure. It is cheap and easily cut. As well as being adapted to distinctive art, it finds a customer in the residential builder, because of the uniformity of its strata and layers. These factors make it possible to split in any dimension with a minimum amount of labor, thus making it possible to construct at a very low estimate. It possesses a remarkable degree of elasticity, and is noted for the fineness of its texture, which enables the cutter to express in his workmanship both accuracy and precision.

This stone also possesses two distinctive colors, generally known as buff Amherst and Grey Canyon. These characteristics are considered very important by architects, as aiding them in design, "both for interior and exterior decoration."

CONNECTICUT BROWNSTONE

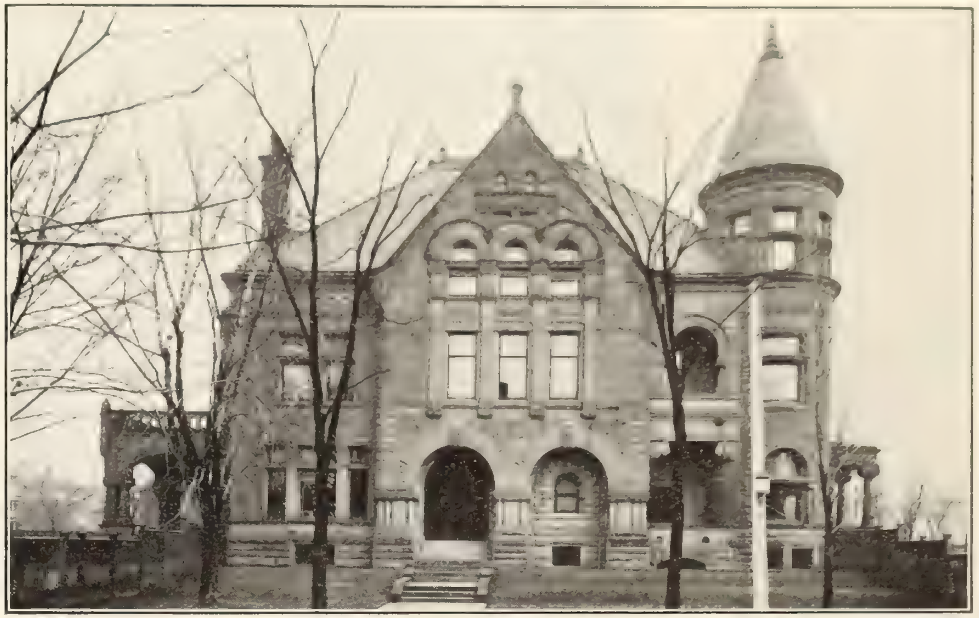
This stone is quarried at Portland, Connecticut, and has been used in the construction of many of the best buildings in the United States and Canada, both for general utility in buildings and for monumental works. Its color is a rich dark brown, not unlike those quarried in Nova Scotia and New Brunswick. It is absolutely free from clay, marl or gravel, which weather out on exposure to the atmosphere or cause fractures in working, and if laid upon its natural bed it is calculated to withstand the ravages of time and weather for many generations.

Many noted buildings in the States date so far back that they have become landmarks in history. In this particular mention might be made of the Connecticut

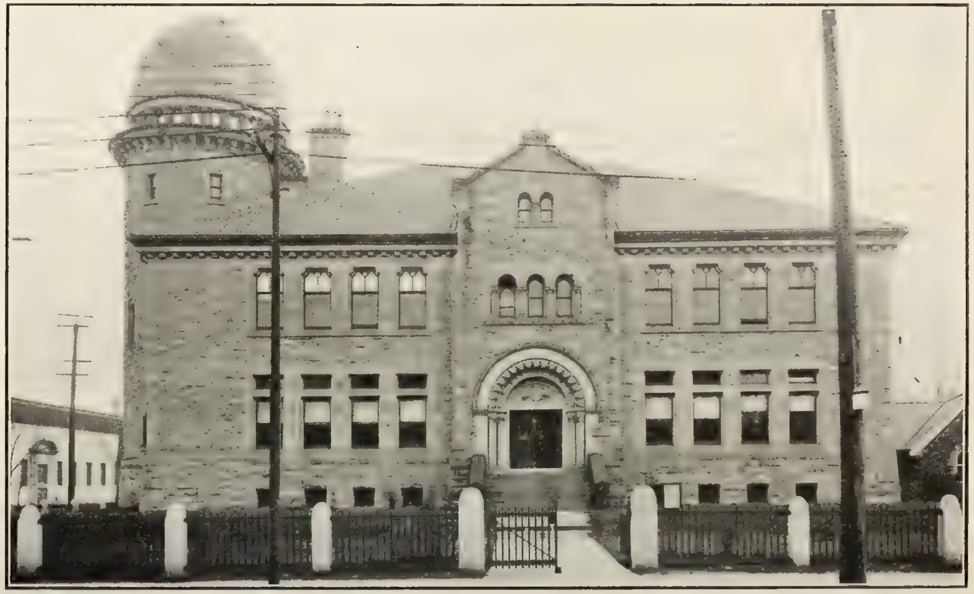


The Moose Club, Sherbourne Street, Toronto. Connecticut brownstone.

The Nature and Utility of Building and Ornamental Stones



Club House, St. George and Bloor Streets, Toronto. Portage sandstone.



Meteorological Observatory, Bloor Street West, Toronto. Miramichi sandstone.

Parliament Buildings, (North Entrance,) Toronto. Sackville sandstone.

State House at Hartford, which was built in the year 1794. Connecticut Brown Stone has stood not only the test of time and weather, but also of fire. The Flood residence, on Nob Hill, San Francisco, demonstrated during the earthquake, and the fire which followed, the remarkable power if this stone to resist the ravages of fire, in so far as it is still a remarkable building, and shows but little sign of deterioration.

PORTAGE BROWN SANDSTONE

The characteristics of Portage Sandstone are very similar to Connecticut stone, both in color and chemi

Confederation Life Building, Richmond Street, Toronto.
Portage sandstone.

Toronto City Hall.
Sackville and Credit Valley sandstone.

Residence, Elm Avenue, Toronto. Sackville sandstone.

cal constitution. This is a stone possessing a very fine texture and depth of color. If the reader will take the trouble to examine the Yonge Street entrance to the Confederation Life Building (Toronto), and the twisted columns on Richmond Street, it will leave no room for doubt regarding the possibility of expressing therein artistic design. It fulfils the desired qualifications of beauty, strength and durability—the requisites of a good sound building material.

MIRAMICHI SANDSTONE

New Brunswick

The Miramichi Sandstone is unique in its formation, and the irregularity of its lines, combined with its buff color, invite the claim of its being select. It presents a very fine texture, thus suggesting the possibility of inscribing high and expressive art, is uniform in color, weathers well, and is not susceptible to discoloration. Its color is pleasing to the eye, and it maintains its clean-cut outlines through generations of time and exposure.

NEW BRUNSWICK BROWNSTONE

Sackville

The most noted and extensively used Sandstone of New Brunswick is known as "Sackville," the isolated formation of rock deposited at Sackville during the new red stone period, so graphically described by Dawson, the noted geologist, as being unique and very different from any other deposit in the province. The formation is in horizontal beds, from 2 feet to 9 feet thick, and is uniform both in color and quality, which renders it a very useful material for building and architectural designs. It blends with the color of brick, is

Residence, Deancroft, Glen Road, Toronto. New Brunswick sandstone.

strong and durable, as well as being one of the cheapest cutting stones on the market. During the past few years there has been a great expansion in this particular stone area.

ONTARIO SANDSTONES

Grey Medina Sandstone

Grey Medina sandstone, is the finest building stone at present produced from the sedimentary rocks of Ontario. While minor variations, such as greater or less development of "reed," slight difference in hardness, color and brilliancy, are to be noted, the general character of the grey Medina may be inferred from the following description. The general color of the stone is mottled grey. In places it is quite uniform, but fine horizontal lines, representing the bedding planes, may be observed in most of the stone, particularly after weathering for a short time. On treatment with carbonic acid in water, the color is not materially affected.

Confederation Life Building, Yonge Street, Toronto.—Portage sandstone

Under the microscope the quartz grains have an average diameter of less than one-eighth of a mm. There is, however, a large number of very fine grains scattered between the larger ones. Considerable feldspar in a partly decomposed condition is present, as well as several other minerals in very small amount. The cement, which is largely of a calcareous character, is quite evident, but interstitial pores are not to be seen with distinctness, despite the high percentage of pore space.

In response to a request, we herewith append a brief summary of the limestones of Ontario with information as to their physical capacity and chemical constitution

Limestones of Southern Ontario

The province is rich in limestones of various kinds, some of them well adapted to building purposes, others particularly suited to heavy construction, and others which find a use in a great many ways outside the scope of this report. East of the Archaean axis, building stone is obtained from the Beekmantown, the Chazy, the Black River, and the Trenton formations. West of the axis the chief formations yielding good stone are the Black River, the Trenton, the Niagara, the Guelph, the Onondaga, and the Hamilton. The stone from each of these formations, while presenting many variations from place to place, is characterized by certain features which make its recognition comparatively easy. In the summaries appended to the descriptions of the different areas will be found a general statement as to the character of the stone.

St. Mary's Area—Onondaga Formation

The physical properties are as follows:—

Specific gravity	2.709
Weight per cubic foot, lbs.	167.513
Pore space, per cent.	0.92
Ratio of absorption, per cent.	0.34
Coefficient of saturation	.72
Crushing strength, lbs. per square inch	18242.
Crushing strength after freezing, lbs. per square inch	20194.
Loss on freezing, per cent.	0.015
Loss on treatment with carbonic acid, c.c. per square inch per hour	0.3221
Transverse strength, lbs. per square inch	3474.
Chiselling factor	5.5

No inclusion or large fossils detract from the value and it must be regarded as a very desirable stone.

An analysis from one of the upper beds is as follows:

Water	0.14
Silica	2.32
Ferric oxide	0.88
Alumina	0.17
Calcium carbonate	94.24
Magnesium carbonate	2.19

Queenston Area—Niagara Formation

This limestone is distinctly bluish in color, but on weathering it looses the blue and assumes a pleasing grey.

Specific gravity	2.789
Weight per cubic foot, lbs.	162.015
Pore space, per cent	[illegible]
Ratio of absorption, per cent	2.67
Permeability, c.c. per square inch per hour	5.
Coefficient of saturation	0.32
Crushing strength, lbs. per square inch	18691.
Crushing strength after freezing, lbs. per square inch	[illegible]
Loss on freezing, per cent	0.092
Loss on treatment with carbonic acid, grams per square inch	0.0581
Transverse strength, lbs. per square inch	2361.
Chiselling factor	4.6

Analysis: H. A. Leverin, Mines Branch laboratory:

Insoluble matter	[illegible]
Ferrous oxide	[illegible]
Ferric oxide and alumina	.60
Calcium carbonate	72.37
Magnesium carbonate	24.12
Sulphur	[illegible]

Marmora Area—Trenton Formation

Specific gravity	2.723
Weight per cubic foot, lbs.	169.827
Pore space, per cent	0.066
Ratio of absorption, per cent	00.024

Crushing strength, lbs., per square inch, 37705 (the highest result for any stone referred to herein).

Most of the beds of this quarry produce a building stone of a hard and durable character in sizes convenient for handling. The marketable output varies from 5 to 14 inches in thickness and is practically inexhaustible. The stone splits easily along the bedding, and at right angles to that direction breaks with a clean fracture, so that rectangular blocks are easily prepared. For rock face work the stone is highly desirable, but as it is somewhat brittle and is possessed of a strong conchoidal fracture it does not chisel easily. Dressed work is liable to be marred by the flaking off of shell-like chips unless great care is taken in the operation.

Mountain Area—Peekmanton Formation

On weathering, the stone becomes still darker and assumes a minutely punctuate appearance. Treatment with carbonic acid produces the same effect, but not to such a marked degree. Microscopically, the stone is composed of a mass of small crystals of dolomite averaging about ¼ mm. in diameter. Scattered larger crystals are seen throughout the finer grained base. Open interspaces are very apparent; these seem to ramify and to run irregularly through the stone.

The physical properties are as follows:—

Specific gravity	2.836
Weight per cubic foot, lbs.	151.38
Porosity, per cent	12.607
Ratio of absorption, per cent	5.09
Coefficient of saturation	0.3
Permeability, c.c. per square inch per hour	13.12
Crushing strength, lbs. per square inch	15588.
Crushing strength after freezing, lbs. per square inch	13280.
Loss on freezing, per cent	0.081
Loss on treatment with carbonic acid, grams per square inch	0.01228
Transverse strength, lbs. per square inch	1130.
Chiselling factor	5.4

Chemical Analysis:—

Insoluble matter	1.08
Ferrous oxide	.76
Ferric oxide and alumina	.56
Calcium carbonate	55.53
Magnesium carbonate	42.14
Sulphur	0.29

Pembroke Area—Chasy Formation

In structure the stone is exceedingly fine grained and shows distinctly its composition of substances of different chemical nature.

The physical properties are as follows:—

Specific gravity	2.776
Weight per cubic foot, lbs.	171.628
Pore space, per cent	0.936
Ratio of absorption, per cent	0.340
Permeability—not determined	
Coefficient of saturation—not determined	
Crushing strength, lbs. per square inch	22706.
Crushing strength after freezing, lbs. per square inch	24500.
Loss on freezing, per cent	0.028
Loss on treatment with carbonic acid, grams per square inch	0.112
Transverse strength, lbs. per square inch	2441.
Chiselling factor	5.2

This stone is compact, fine grained and easily chiselled. It has a strong tendency to split along the stratification and to chip out under the chisel. The color and weathering qualities are not of high character, although the strength appears to increase under the freezing test.

The following analysis indicates the chemical character of the stone:—

Carbonate of lime	83.96
Carbonate of magnesia	9.29
Carbonate of iron	0.69
Insoluble	6.06

Longford Area—Black River Formation

On weathering, this stone becomes very white with fine dark lines.

Specific gravity	2.701
Weight per cubic foot, lbs.	167.85
Pore space, per cent	0.408
Ratio of absorption, per cent	0.152
Coefficient of saturation	0.95
Crushing strength, lbs. per square inch	25000.
Crushing strength after freezing, lbs. per square square inch	19723.
Loss on freezing, grams per square inch	0.0049
Loss on treatment with carbonic acid, grams per square inch	0.189
Transverse strength, lbs. per square inch	2324.
Chiselling factor (somewhat doubtful as the stone broke and shattered)	4.86

Miller gives the following analyses:—

	Bed Probably Corresponding to No. 152.	Top-rotten Bed.	Yellow Bed.
Lime	53.42	52.42	34.28
Magnesia	.72	.85	16.25
Carbonate dioxide	42.68	42.00	44.70
Ferric oxide	.62	.22	.54
Alumina	.....	.41	.72
Sulphur trioxide	.17	.30	.....
Alkalies	.05	.....	.....
Silica	.....	.....	.....
Insoluble residue	2.78	1.38	2.80
Loss on ignition	.....	1.79	.....
Water	.72	.....	.06
Sulphuric acid	.....	.....	.44

Galt Area—Guelph Formation

Specific gravity	2.837
Weight per cubic foot, lbs.	151.17
Pore space, per cent	14.62
Ratio of absorption, per cent	6.05
Permeability, c.c. per square inch per hour	155.1
Coefficient of saturation	0.48
Crushing strength, lbs. per square inch	10990.
Crushing strength after freezing, lbs. per square inch	9801.
Loss on freezing, per cent	0.232
Loss on treatment with carbonic acid, grams per square inch	0.0148
Transverse strength, lbs. per square inch	817.
Chiselling factor	6.8

It will be observed that this stone has a rather low crushing and transverse strength and a high porosity. The ease with which it may be carved is indicated by the high chiselling factor of 6.8.

Fossiliferous limestone is specially adapted for standing enormous strain, and has been extensively used for piers of bridges.

Proportioning Concrete Aggregate[1]

Diagrams for Obtaining Proportions of Cement, Sand and Crushed Rock or Gravel to Make a Maximum Density Concrete

DIAGRAM No. 1 is for determining the percentages by weight of different sized sand, crushed rock or gravel, so that an aggregate mixed according to these percentages will have the smallest per cent. of voids possible or, in other words, be of maximum density. These curves are based on the ellipse-tangent theory as explained by Taylor and Thompson.

The percentages of the various sized materials depend on the maximum size of crushed rock or gravel used and the mesh of the screens that represent the limiting sizes of the various parts of the aggregate.

The method of using this diagram is as follows:

First, when sand and only one class of gravel or broken stone are to be used.

Example:

Material.	Size.
Sand	Passes ¼-inch and remains on 0.
Gravel	Passes 3-inch and remains on ¼-inch.

Find where the "sieve opening," which is the division line between the maximum size of sand and the minimum size of gravel, intersects the proper "maximum size of rock" line. For the example given the ¼-inch sieve opening line intersects the 3-inch maximum size of rock line at A, Diagram No. 1. A horizontal line through the point A to B will give the per cent. by weight of sand required—34 per cent. in this case. 100 per cent. minus 34 per cent. equals 66 per cent., which is the per cent. by weight of gravel required.

A denser aggregate can be obtained by using more than two sizes of material, and, as a general rule, the more sizes of materials used the less the per cent. of voids in the aggregate. For this reason the following example is given.

Second, when sand and a medium and coarse gravel are used.

Example:

Material.	Size.
Sand	Passes 0.1-inch, remains on 0.
Medium gravel	Passes 1¼-inch, remains on 0.1-inch.
Coarse gravel	Passes 2½-inch, remains on 1¼-inch.

The 0.1-inch sieve size intersects the "maximum rock equals 2½-inch" curve at C, Diagram No. 1, and gives 27 per cent. of sand.

Where the 1¼-inch sieve line intersects the "maximum rock equals 2½-inch" curve at D gives 64 per cent. of sand and medium gravel. 64 per cent. minus 27 per cent. equals 37 per cent. This is the per cent. of medium sized gravel required. 100 per cent. minus 64 per cent. equals 36 per cent., the percentage of coarse gravel required.

Crushed rock can, of course, be used instead of gravel, the method of using the diagram being the same in either case.

Percentages by weight of more than three sizes of materials may be determined in the same manner. Using materials sifted from "run of the bank" gravel, voids as low as 14 per cent. have been obtained by the author by the above method.

After the proper per cents. of the various sized materials have been found, a mixture or aggregate is

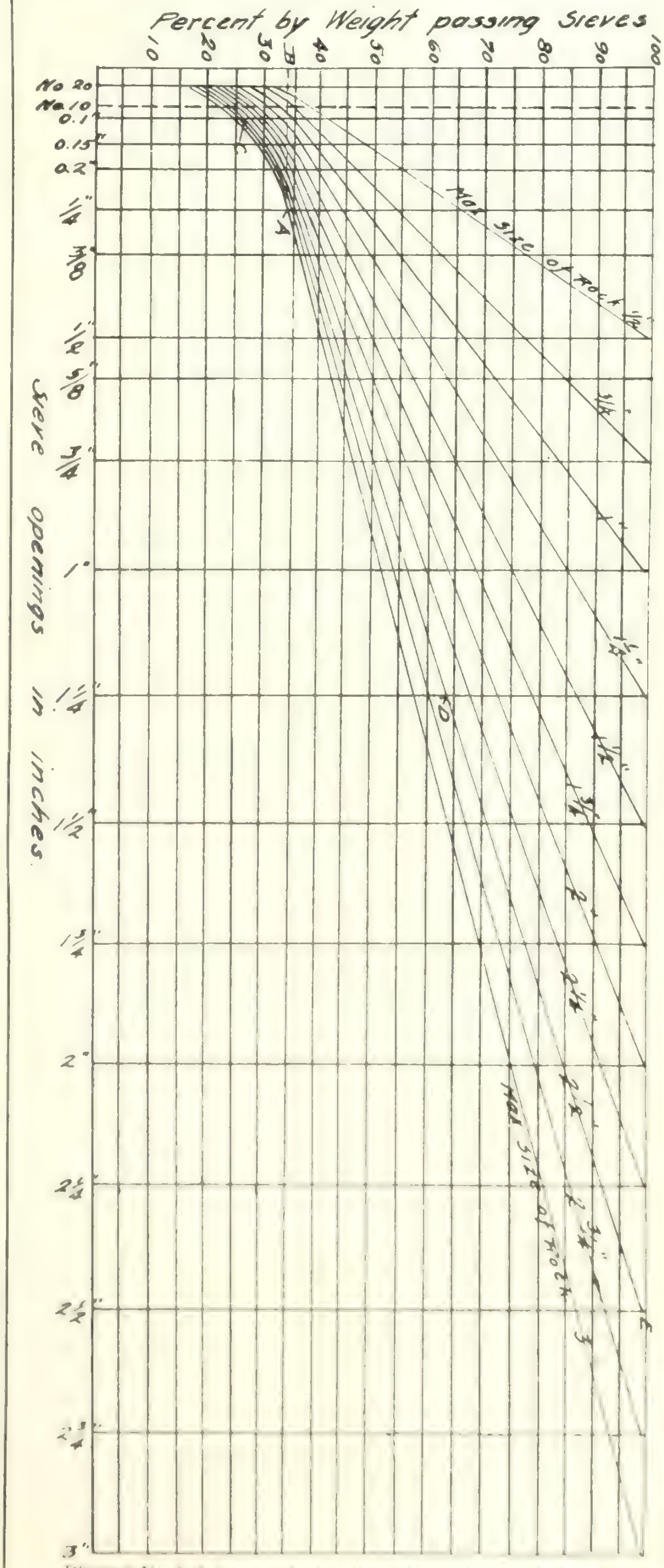


Diagram No. 1, for proportioning sizes of gravel or crushed rock and sand for maximum density made according to these percentages and the weight of a cubic foot of it is found by first compacting as much of the mixture as possible into a box that holds exactly one cubic foot, and then weighing this box full of aggregate, after which the weight of the box it subtracted, leaving the weight of a cubic foot of aggregate.

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[1] By F. C. Snow in The Municipal Journal

The specific gravity of the material in the aggregate is found by experiment or assumed from the table which follows, and with the weight per cubic foot and the specific gravity known the per cent. of voids in the gregate, after which the weight of the box is subtractstraight line on this diagram passes through the specific gravity, the weight per cubic foot and the per cent. of voids, as shown by the line ABC. At A the weight per cubic foot of the material is shown to be 130 pounds; at C the specific gravity is 2.66, and at B the per cent. of voids is found to be 22.

Table of Specific Gravities

Material.	Specific Gravity.
Sand	2.65
Gravel	2.65
Granite	2.7
Limestone	2.6
Trap	2.9
Slate	2.7
Sandstone	2.4
Cinders	1.5

The per cent. of cement to use is found by the following formula, which allows 2 per cent. excess of cement over enough to fill the void in the aggregate.

$$\frac{(\text{Per cent of voids plus 2 per cent.}) \times (\text{Weight of a cubic foot of cement})}{\text{Weight of a cubic foot of aggregate}}$$

or, if a cubic foot of cement weighs 96 pounds, the per cent. by weight of cement to use equals

$$\frac{96\,(\text{per cent. of voids in aggregate plus 2 per cent.})}{\text{Weights per cubic foot of aggregate}}$$

The proof of this formula is apparent.

Example: Weight per cubic foot of aggregate, 130 pounds; per cent. of voids in aggregate, 22; per cent. of cement required equals $\frac{96\,(22 + 2)}{130}$, equals 18 per cent.

If the aggregate in the two-size material problem given above weighed 130 pounds per cubic foot and had a specific gravity of 2.66, then the proper mixture by weight would be: 18 per cent. cement, 34 per cent. sand (0 to ¼-inch), 66 per cent. gravel (¼-inch to 3-inch), or 1 cement : 1.9 sand : 3.7 gravel.

It is usually the practice, however, to proportion

The smaller illustration, Diagram No. 2, is for percentage of voids in crushed rock, gravel or sand; the larger, Diagram No. 3, is for obtaining proportions by volume for concrete.

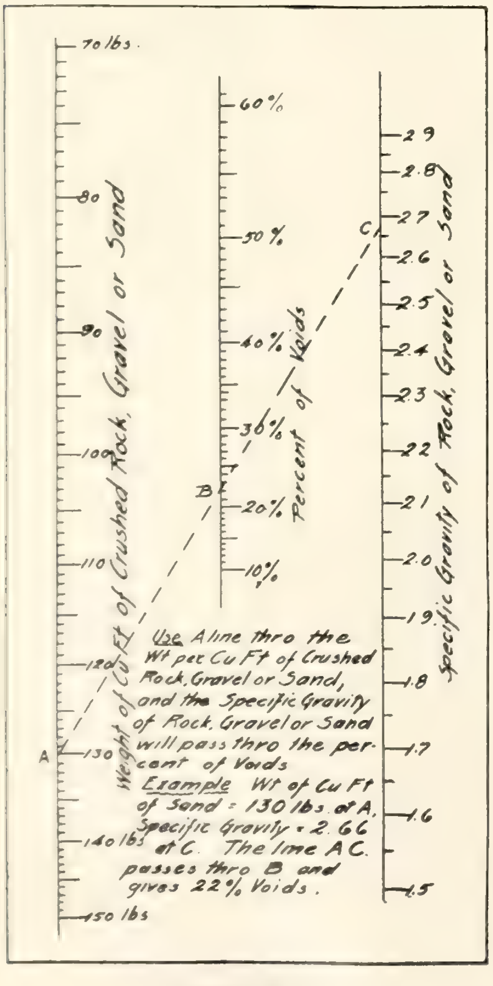
70 lbs.
80
90
100
110
120
130
140 lbs
150 lbs
Weight of Cu. Ft. of Crushed Rock, Gravel or Sand
60%
50%
40%
30%
20%
10%
Percent of Voids
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
Specific Gravity of Rock, Gravel or Sand
A
B
C
Use A line thro the Wt per Cu Ft of Crushed Rock, Gravel or Sand, and the Specific Gravity of Rock, Gravel or Sand will pass thro the percent of Voids
Example Wt of Cu Ft of Sand = 130 lbs. at A, Specific Gravity = 2.66 at C. The line A C. passes thro B and gives 22% Voids.

Diagram No. 2.

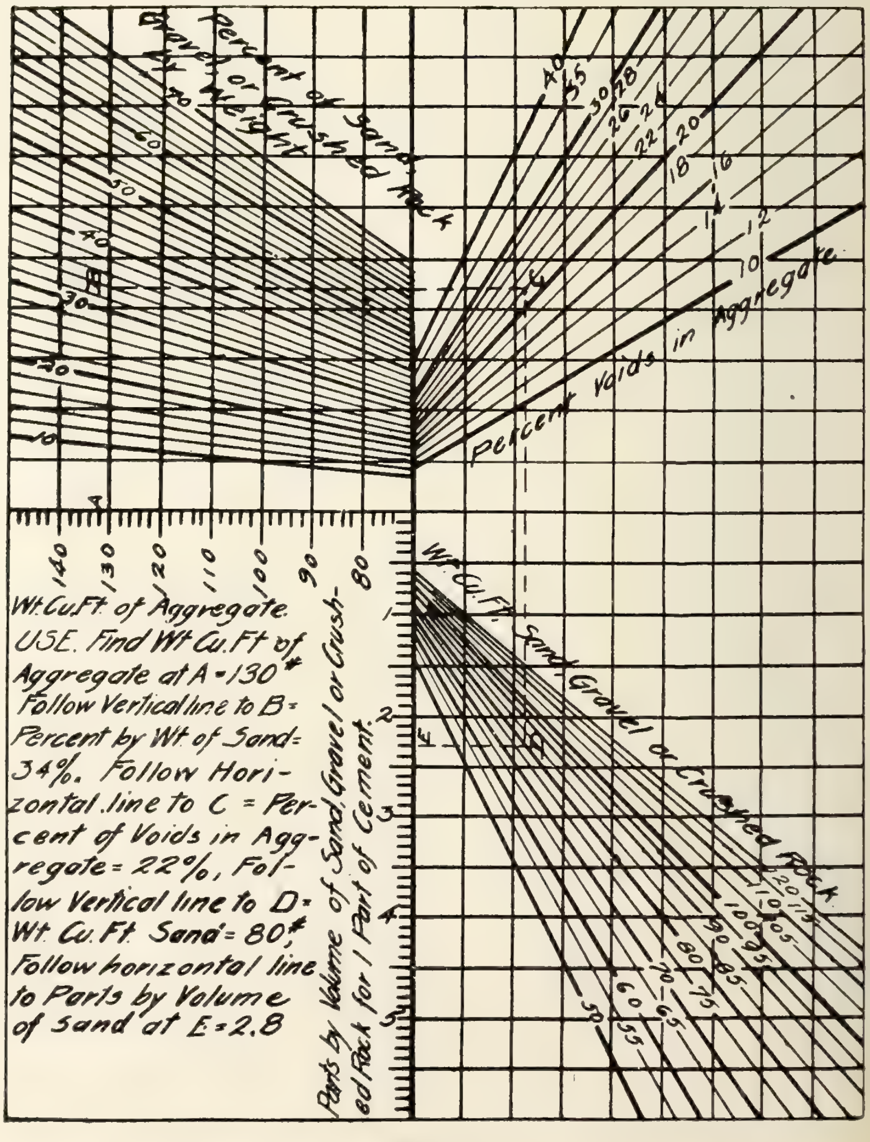
Percent of Sand, Gravel or Crushed Rock by Weight
70
60
50
40
30
20
10
40
35
30
28
26
24
22
20
18
16
14
12
10
Percent Voids in Aggregate
B
C
140
130
120
110
100
90
80
Wt. Cu. Ft. of Aggregate.
USE. Find Wt Cu. Ft of Aggregate at A = 130# Follow Vertical line to B = Percent by Wt of Sand = 34%. Follow Horizontal line to C = Percent of Voids in Aggregate = 22%, Follow Vertical line to D = Wt Cu. Ft Sand = 80# Follow horizontal line to Parts by Volume of Sand at E = 2.8
1
2
3
4
5
E
D
Parts by Volume of Sand, Gravel or Crushed Rock for 1 Part of Cement.
Wt. Cu. Ft. Sand, Gravel or Crushed Rock
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50

Diagram No. 3.

Proportioning Concrete Aggregate

by volume and for the purpose of determining the proportions by volume Diagram No. 3 has been prepared.

It is necessary to obtain the weight per cubic foot of each class of material that goes into the aggregate in order to use this diagram, and this can be done by using the cubic foot box as explained above:

The use of Diagram No. 3 is as follows:

Find the weight of a cubic foot of the aggregate as at A (130 pounds). Follow a vertical line through this point to B, the per cent. by weight of sand is determined from Diagram No. 1 (34 per cent). Follow a horizontal line from B. to C, the per cent. of voids in the aggregate is found from Diagram No. 2 (22 per cent.). Follow a vertical line down to weight per cubic foot of sand, as at D (80 pounds). Follow a horizontal line through D to E, where the parts by volume for one part of cement are obtained (2.6).

The parts by volume of gravel are found in exactly the same manner, the proper percentage by weight and weight per cubic foot being used.

Example:

Material.	Size.	Wt. per cu. ft.	Per cent. by Wt.	
Sand	0 to 0.2″	103	39	From Dia. No. 1.
Medium Crushed Rock	0.2″ to ⅜″	100	15	
Course Crushed Rock	⅜″ to 1″	92	46	
Aggregate		139	100	

Specific gravity of aggregate, 2.65; per cent. of voids in aggregate from Diagram No. 2, 16. Proportions by volume from Diagram No. 3: Cement, 1; sand, 2.9; medium rock, 1.1; coarse rock, 3.8.

The formula on which Diagram No. 3 is based is:

$$\frac{1}{\text{weight per cubic foot of aggregate}} \text{ equals volume of aggregate;}$$

(volume of aggregate) x (per cent. of voids in aggregate plus 2 per cent.) equals volume of cement; or

(1 Volume of cement equals

$$\frac{\text{per cent. of voids in aggregate plus 2 per cent.}}{\text{weight per cubic foot of aggregate.}}$$

(2) Volume of sand equals

$$\frac{\text{(per cent. of sand by weight)}}{\text{weight per cubic foot of sand.}}$$

(3) Volume of crushed stone equals

$$\frac{\text{(per cent. of crushed stone)}}{\text{weight per cubic foot of crushed stone.}}$$

Dividing (1), (2) and (3) by 1:

Volume of cement equals 1.

Volume of sand equals

$$\frac{\text{(per cent. sand by weight) (weight per cubic foot of aggregate)}}{\text{(per cent. voids in aggregate plus 2) (weight per cubic foot of sand)}}$$

Volume of crushed stone equals

$$\frac{\text{(per cent. stone by weight) (weight per cubic foot of aggregate)}}{\text{(per cent. voids in aggregate plus 2 per cent.) (weight per cubic foot of stone)}}$$

These two equations are similar, and Diagram No. 3 is based on either one.

A bill vesting in the Board of Estimate and Apportionment the power to regulate the height of buildings has been signed by the Mayor of New York and now becomes law. Under the act the city will be divided into zones for the regulation of the height and character of new buildings.

Rapid Progress in the Electrical Field

In a paper read before the Royal Society of Canada, which held its meetings last week in Montreal, Professor L. A. Herdt, of McGill University, dealt with the tremendous developments in the electrical field which have taken place in the last ten years, due largely to the progress which electrical engineers have made in the economical transmission of electrical energy over long distances by tapping the innumerable rivers and streams flowing to the sea from the highlands. Practically every city or town in the province of Quebec, Ontario, Manitoba and British Columbia is furnished with light and power obtained by hydro-electricity. It was, continued Prof. Herdt, a good steam plant that was able to utilize 10 per cent. of the energy of the fuel, while the hydro-electric plant was capable of utilising as much as 70 per cent. of the energy of a waterfall. In the future, development of power transmission will no longer be restricted to the multiplication of local systems covering a few hundred miles, but will be in the direction of the construction of great plants placed at different points of a system extending its transmission and distribution lines over vast territories in the form of a single network. This will supply energy in the form of electricity for all our wants in the way of light, heat and power. Electric power and heat have a multitude of new services to render yet undreamed of, and will as years go by find a wide application for purposes at present but tentatively held out.

Supplies in Improved Demand at Montreal

There is a little better demand for builders' supplies at Montreal. Since the first of March the National Brick Company of Laprairie have been fairly busy, for although the large buildings in course of construction are very few, there is a considerable number of residences being built. The company have declared the regular quarterly dividend of 1½ per cent. Cement is being purchased more freely and other materials are in normal request. The demand for lumber is not up to expectations, and although stocks are low, there is no prospect of any substantial improvement. There is talk of trouble with the carpenters, who claim that they are entitled to a rise of 2½c an hour to 45c. The masters however stated that the agreement was conditional on the union enforcing the standard rate on all employers; this has not been done, and in consequence they decline to recognise the validity of the agreement.

A Substitute for Cement

In Turkey where cement is not used or hardly known, a substitute has been found that has met with rather good results when applied in exposed places, in filling crevices in water pipes, covering joints in stone floors, in fountains and for numerous other purposes where cement would be required. The mixture is as satisfactory in water as in exposed places, but it must be allowed to become thoroughly dry before it is submerged. The mixture is slaked lime, linseed oil and cotton fibre. Generally a hollowed-out stone is used, although a flat, hard surface will answer, and the process is started by pouring the oil on a handful of cotton, after which the lime is dusted in. It is then kneaded until the whole is thoroughly mixed and about the consistency of dough. The more it is kneaded the better it becomes.

Estimating the Cost of Earthwork and Concrete Construction

Specially Contributed by L. B. Merriam, M. Can. Soc. C. E.*

ESTIMATES of cost of large engineering works should be predicated upon knowledge of the conditions to be met, the amount of each class of work to be done, and the methods of construction best adapted to the conditions to be met. The work should be divided for estimate purposes into classes and each class should be divided again into units, each unit to cover all work where the same or similar methods and appliances are to be used. These units should be studied and a method of construction outlined. This method should be divided into its component parts and a basis of cost figured. While there are seldom two construction jobs alike, they are all accomplished by the same tools and machinery applied differently. This difference of application causes the cost of the unit of comparison to vary largely.

Sometimes you hear such a question as, "What is the price per cubic yard of concrete in this vicinity?" and if you answer, "From $5.50 to $25.00," it would probably be taken as a joke. But gravel concrete mixed one to eight where gravel can be handled directly from the car to the mixer and concrete from the mixer to the foundation trenches at small cost and where yardage in the trenches is large, concrete can easily be put in for $5.50 with cement at $2.00 per bbl. and gravel at $1.25 per cu. yd. On the other hand, where team haul is long on material, forming is complicated, quantity small per square foot of forming, with high grade concrete and special materials and surface treatment required, the work could easily cost $25.00 per cu. yd.

The cost of concrete, then, for any particular job varies with the conditions and requirements, and these varying requirements are paid for as material and labor. The materials used are cement, sand, gravel, crushed stone and lumber and hardware for forms. The labor may be performed either by hand or by machinery.

For convenience and accuracy, certain auxiliary items of labor and material are consolidated and various material and labor units are considered a part of them, thus:

The cost of cement consists of

1. Cost on cars at nearest available track.
2. Cost of handling from car to wagon.
3. Cost of hauling.
4. Cost of unloading.
5. Cost of storage shed.
6. Cost of packages lost or damaged.

The cost of sand consists of,

1. Cost on cars at nearest available siding.
2. Cost of handling from cars to wagons.
3. Cost of hauling.
4. Cost of unloading.
5. Cost of bins or other storage facilities.

In the same way the cost of gravel and crushed stone at the site of the work and ready for use may be analyzed. Lumber for forms must also be delivered on the work, with all mill and machine work performed, then the labor cost of erecting the forms is to be figured from experience in similar work. Where there is a duplication of forms, as in the construction of several piers of the same shape and size, the simplest method is to figure the cost of forming for one pier in detail and then by dividing by the number of cubic yards of concrete to be placed in that pier, obtain the cost per yard of concrete chargeable to forms. Where steel or other unit forms are used, or where lumber is to be used several times, then the total cost of material and labor used in connection with the forms must be divided by the total yardage to get the unit cost of forms.

Having thus found the unit cost of all material, the cost of 1-2-4 concrete can be tabulated as follows:

Cost of Concrete		Per Cu. Yd.
Forms, material and labor		$0.90
Cement, 1.57 barrels at $2.20		3.45
Sand, .44 cu. yds. at $1.40		.62
Stone, .88 cu. yds. at $1.80		1.58
Labor on cement, storage to mixer		.05
Labor on sand, storage to mixer		.22
Labor on stone, storage to mixer		.44
Mixer, rent of machine per day	$1.25	
Coal, 500 lb. per day	2.00	
Oil and waste	.25	
Engineer per day	4.00	
Loader and dumper	2.50	
Total per day	10.00	
At 100 cu. yds. per day		.10
Labor handling concrete to forms		.55
Foreman time keeper		.08
Actual field cost		$7.99

In addition to this cost there is the expense of getting plant on the ground, cost of bidding on several jobs in order to get one, insurance of workmen against accident, cost of surety bonds if any, and interest on the money used to purchase the materials in advance of their use and to meet the pay-roll and other expenses, and interest on deferred payments which are held back until the final estimate. These will be called overhead expenses and will be discussed later in detail. For the present case we will call this item five per cent. and the contractor's profit is taken as ten per cent., making the price of this cubic yard of concrete $9.20 for a contractor's bid, or $9.50 for an engineer's preliminary estimate.

The following quantities for materials per cubic yard of concrete for various quantities have been found very close to being correct and can be used in estimating costs and ordering material. Cement is figured in Canadian standard barrels of 350 lbs. net.

Mixture	Cement bbl.	Sand cu. yds.	Stone, cu. yds.
1-2-3	1.83	0.51	0.77
1-2-4	1.57	0.44	0.88
1-2½-5	1.29	0.45	0.91
1-3-5	1.22	0.51	0.86
1-3-6	1.10	0.46	0.93

Where good bank gravel is used without screening, one cubic yard of gravel and 1¼ barrels of cement will make a yard of concrete, but it is better to screen the sand from a cubic yard of gravel, measure this sand and put in cement enough to amount to 40 per cent. of the bulk of the sand, figuring 3.5 cubic feet as a barrel of cement. This, with good bank gravel, will make a concrete of the same class as the 1-3-5 mixture.

The study of concrete costs indicates that economies are possible in form design, in handling material from storage to the mixer and concrete from the mixer to the forms. Form design should be studied with an aim to reducing cost of forming and this feature in certain cases may set a pace for the work. When the work is delayed to permit the form material to be used more frequently, careful study of the effect of this delay on the overhead as well as other expenses should be made.

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*Consulting Engineer, Winnipeg.

Material may be handled from storage to the mixer by wheelbarrows, man carts, horse and cart, track and dump cars or by conveyors of various kinds. Concrete may be handled by similar methods and also by elevating it and then conveying it to the forms by means of sheet iron chutes. This last method has proved to be very economical where applicable and properly installed. Narrow-gauge dump cars travelling on light steel rails and propelled by men, cables or electric locomotives are very efficient.

The point to be borne in mind is that the plant must be co-ordinated and should be designed in standard units so that as far as possible, all parts may be used on future work.

In making an estimate for any project, a complete schedule of the component parts should be made up and each part should be analyzed. In railroad work the general division of the component parts of the estimate are listed below.

Surveys
Clearing
Grading
Culverts
Ties
Track fastenings
Track laying
Ballast
Station buildings
Section houses
Watchman's houses
Engine houses and turntables
Water stations
Fencing
Stock yard
Crossinge, cattleguards, signs.
Dock and wharves
Grain elevators
Electric and gas plants
Construction equipment
General office expense
Engineering and accounting

Right-of-way
Grubbing
Tunnels
Bridges
Rails
Frogs and switches
Surfacing
Ballasting
Station furniture and equipment
Bunk houses
Tool houses
Shops and their equipment
Fuel stations
Snow fences and shed
Loading platforms
Interlocking and signalling
Transfer boats
Storage warehouses
Telegraph lines
General offices
Interest during construction

Provision for the maintenance of the road during the construction period.

Clearing right-of-way is estimated by the acre and is generally a comparatively small item in any job. The cost varies widely with the character of the timber to be cut and the specifications as to the height of stumps and disposal of logs and brush. One man will cut about one-half of an acre of small sized timber of open growth a day. In large timber he will cut about one-tenth of an acre and the cost of piling and disposal of the brush is about the same as cutting, so the cost per acre of the clearing will vary from six days to twenty days' wages with proper allowances for foreman and overhead. The cost of grubbing out stumps and roots varies even more widely than the cost of clearing. The only method of estimating where the quantities are too small to warrant the installation of machinery, is from experience under similar conditions making allowance for any difference in labor conditions and cost. Where machinery is to be installed, a count of the stumps over an average area of, say, 100 feet square, will give close data for an estimate.

Grading may be further subdivided as follows:

Schedule 1.

WORK	CLASS	UNIT	METHOD
Grading	Ditching	Wasted	Man Work. 1 Drag Scraper.
		Hauled	2 Drag Scraper. 3 Wheel " 4 Fresno " 5 Elevating Grades.
	Borrow Teams..		2. 3. 4. 5.
	Borrow Steam Shovel............	Wagon Haul	6 Steam Shovel Traction Wheels Dump Wagons.
		Train Haul	7 Steam Shovel R. R. Wheels. Dinkies, Cars and Track.
	Excavation from Roadway Common Excavation. ..	Wasted...	2. 3. 4. 5. 6. 7.
		Placed in embankment	2. 3. 4. 5. 6. 7.
	Road Crossings		
	Excavation from Roadway Classified ..	Wasted	8 Drilling and Blasting. 9 Shovels and Wheeled. 10 Shovels and Carts.
		Placed in embankment	5. 6. 7. 3. 4.
		Overbreak	11 Handling.
	Overhaul	Teams	12 Wagons.
		Train	13. Cars and Track.

This general outline is simply an illustration of some of the numerous characteristic conditions and is used only as explanatory of and auxiliary to the following schedule for estimating the average cost of common excavation.

Schedule 2. Grading Schedule for Estimate.

Common Excavation

Station to station			Unit method	Amount cu. yds.	Cost per cu. yd.	Total cost
0	—	45	2	13500	$0.114	$1,539.00
45	—	60	4	9000	0.106	954.00
60	—	85	3	15100	0.108	1,630.80
85	—	138	7	80000	0.182	14,560.00
				117600	$0.159	$18,683.80

The whole line should be gone over in the manner shown and each unit method number may appear many times and with a different cost placed opposite to it, as the conditions vary. At the same time the common excavation schedule is being made, one should also be made covering each class of classified material.

In rock work careful regard should be given to the specifications covering overbreak and their effect upon the cost.

Overhaul is commonly placed in estimates at 1c per cubic yard per 100 feet but this price is seldom proper and for team work is always too low to even pay the cost. Overhaul should be scheduled and an average cost figured.

Grading covers all earth work and rock work necessary to complete construction of a railroad except tunnels and the excavation for foundations of bridges and other structures below water level, although both these items are sometimes included in grading specifications. The profile furnishes all the information required with regard to the quantities of material to be handled and the conditions with regard to haul. These quantities and conditions are not always given in figures but can always be computed from the scale and roadbed and slope conditions given in the specifications. The first thing to do is to compute the quantities and separate them so that the quantities adapted for handling according to any one group method, as shown in Schedule 1, and separately totalled. During the inspection of the line the character of the material as to classification and ease of handling should be noted [illegible] so the cost of handling each part of the work can be made as shown in Schedule 2.

The price attached to each piece of work will be the result of a decision with regard to the method of doing that particular piece of work and the character of the material to be handled, completing the data necessary for the compilation of a schedule along the lines of Schedule 2.

Most of our railroad grading is done by teams and as a precedent to any discussion of the methods of estimating the cost of work done by teams and as a basis for figuring such costs the per diem value or cost of a team of two horses and their driver must be determined. The best method is to estimate all work on the basis of the price at which teams can be hired in the vicinity of the work to be performed. Several other methods are used by different contractors, such as figuring cost, interest on the first cost and depreciation and dividing this sum by the number of days' work to find the cost per day per team then by adding the cost of the feed and care, get at the daily cost of an average team in the following manner:

Cost of team	$500.00
Interest for three years at 10 per cent. ...	150.00
	650.00
Value of team after three years	250.00
	$400.00

Three years' work at 200 days a year gives the cost of the team as 67c a day.

Loss of horses by death and injury brings this up and it is generally assumed at $1.00 per day or more.

An average horse, while working, will require about 20 lbs. of oats and 25 lbs. of hay per day. The quantity will depend largely on the quality, the best being the cheapest. Cost of feed varies with the location and conditions and should be figured for each job.

Teamsters are generally paid by the month with board and cost the contractor from $2.00 to $3.00 per day. So that the actual cost of teams including shoeing, harness, stables, medicine, care and feed in the vicinity of Winnipeg is something less than $5.00 per day, probably about $4.25. This does not include wagons, scrapers or other tools. Teams can be hired at $5.00 per day and this figure will be used as team wage in any examples of cost of work.

Slush scrapers or drag scrapers are applicable to grading work where the material is to be handled only short distances and not lifted to a height of more than five to eight feet, and should generally be restricted to the lower figure. The amount of material handled per team is large under proper conditions but drops off rapidly when conditions are not suitable. In good material with teams traveling 150 feet per trip a 14 team outfit will handle 900 cubic yards with drag scrapers at an expense as follows:

14 teams at $5.00	$70.00
4 scraper holders at $2.00	8.00
2 men trimming bank at $2.00	4.00
1 foreman at $5.00	5.00
1 blacksmith at $4.00	4.00
1 stable boss at $3.00	3.00
1 time keeper at $3.50	3.50
Rent of equipment	5.00
Cost of 900 cu. yds.	$102.50

Cost per cu. yd., 11.4c.

It will cost 5c per cubic yard for each additional 200 feet travel for the teams.

Wheel scraper work is capable of being used where the haul is longer and the lift higher than drag scrapers because the load is larger and the wheels make transportation easier. An eleven-team outfit with No. 3 wheel scrapers working in fair material with each team travelling about 300 feet each trip will handle 900 yards per day at an expense as follows:

11 teams at $5.00	$55.00
4 men loading at $2.00	8.00
2 dumpmen at $2.00	4.00
1 foreman	5.00
1 blacksmith	4.00
1 stable boss	3.00
1 timekeeper	3.50
Rent of equipment	6.50
Cost of 900 cu. yds.	$89.00

Cost per cu. yd., 10c.

It will cost 2c per cu. yd. for each additional 200 feet of travel for the teams.

Elevating grader work is divided into two parts which are separate and distinct, namely, excavating and loading, and hauling, which will be treated as one item and then separated to find the relative cost of each. The average output of this machine is 500 cubic yards per day when loading wagons. Six teams of horses are used to propel it and less men are used than would be required to furnish a teamster for each team. The cost of men and teams is, however, practically the same as the cost of six teams with teamsters. With 1½ cubic yard dump wagons the average load is about 1.1 cubic yards excavation measurement per load and about 450 wagons are loaded per day. Each wagon team loses one-half to two minutes following loading and turning out to start on his trip. The average for a five-hour trial was almost exactly 1 minute, making 450 minutes team time chargeable to loading in addition to the time of the teams employed on the machine, thus making the team time chargeable to loading each day 6.75 team days. The number of teams required to haul away this 500 cubic yards, assuming a rate of travel of 180 feet per minute and 500 foot haul with a loss of one-half minute each trip unloading and turning, is determined as follows:

	Team Days
450 trips with loss of ½ minute each	0.38
450 trips with loss of 1 minute loading	0.75
450 trips 1000 ft. each ... ... $\frac{450,000}{180 \times 60 \times 10}$	4.17
Total	5.30

It will probably take six teams to do this hauling and the output will be increased slightly but not in proportion to the increase, let us say 525 yards output at the following cost:

12 teams at $5.00	$60.00
1 foreman	5.00
2 dumpmen at $2.00	4.00
1 timekeeper	3.50
1 stable boss	3.00
1 blacksmith	4.00
1 helper	2.50
Rent of equipment	6.00
Cost of 525 cu. yds.	$88.00

Cost per cu. yd., 16.8c.

Of this amount there is chargeable to:

Loading	$33.75	38.3%
Hauling	26.25	30.0%
Dumping and leveling	4.00	4.5%
Miscellaneous	24.00	27.2%
	$88.00	100.0%

As the miscellaneous expense is 27.2% of the whole, then by dividing the percentages of the other items by 0.728 and multiplying by 16.8 we have the cost, including everything, of loading 8.9c, hauling 6.9c, dumping and leveling

1c. The miscellaneous charge is large in this case as the gang is too small for economical operation and would ordinarily be about half the percentage shown. To find the cost of any increase or decrease in the length of haul per cubic yard per hundred feet figure the cost of the time of the team while travelling 200 feet and add the miscellaneous percentage and divide by the yardage hauled per load. In this case slightly over one cent per cubic yard per 100 feet.

The steam shovel is one of the most useful and widely used machines for handling earth and rock and is usually the best machine available for excavation of material which is to be transported for use at points distant from the point of excavation. The principles underlying its economical use are simple but are frequently not applied. A shovel which will load in a well organized gravel pit 1,500 cubic yards per day is frequently seen to average half that amount in an excavation where the material is just as easy to handle but where the track conditions with regard to loading cars are not systematized. The shovel output being held down by the fact of no cars being there to be loaded, this condition is very expensive and is brought about by the bad arrangement of tracks or shortage of engines and cars. There does not seem to be any adequate idea of the losses involved, otherwise they would be corrected. Where ever possible, trains should follow each other past the shovel in one direction only, making no reverse movements on the loading track. This conditions is seldom seen. The common condition is a passing track near the mouth of the cut where the loaded train passes the empty train and where the empty train must wait for the loaded train. The distance from the shovel to this track may be anywhere from two or three hundred feet to half a mile. Let us suppose for the purpose of this argument that this passing track is maintained at an average distance of 1,000 feet from the shovel and that the number of trains are ample to enable the empty train to always reach the passing track in time to meet the loaded one and be ready to start as soon as the loads are passed and see the amount of loss. Let us assume that these trains will travel at the rate of six miles an hour and that each train has eight cars of three cubic yards capacity each and that the shovel has an ordinary capacity for loading 1,500 cubic yards per day, including moving up, then it will load its train in 9.6 minutes and it takes the trains 4.6 minutes to make the run and get in position to load or so far as the shovel is concerned it can only load 24 yards in 13.2 minutes or at a rate of 1,090 yards per day. This shows a loss of capacity of over 27 per cent. and an increase in unit cost of the work 37.5 per cent. This is a big leak. They will say that the shovel moves up while the switching is being done, so saving a part at least of this time but experience has shown that where this is attempted more time is lost than in moving at the proper time to move in order to get the greatest efficiency from the shovel. At best the shovel should only move once while loading two or three trains where the average face is eight or nine feet. The time required to move the shovel back to start a new cut is lost and should be as short as possible. With a standard gauge hauling outfit, this time should be very short, ordinarily not exceeding two hours when a track is laid in the pit along the line of the new loading track closely following the shovel, which makes a continuous track for the shovel to move back on. It frequently pays to lay a three-rail loading track behind the shovel where narrow gauge loading outfit is used so as to have a standard gauge track to move the shovel back on. The time saved in moving back is generally costing from $10 to $15 per hour and the saving in actual money is greater than the difference in cost between this method and ordinary and slower methods.

Trains enough should always be provided to keep the shovel at work up to its capacity. With a narrow gauge hauling outfit, even on short hauls, at least two trains should always be used. Assuming as above, a train can be loaded in 9.6 minutes and the speed of the train is six miles an hour or 528 feet per minute and the time required to unload the train is three minutes, then with two trains, the total running time of the train, after deducting the time required to unload will be 6.2 minutes and the longest total travel a train can make and be at the shovel in time will be 6.6 x 528 = 3480 feet. When the distance travelled is longer than this, three trains will need to be put on. By the same reasoning, four trains will be required when the total travel distance of the complete round trip becomes 8,550 feet and an additional train for each increase of total travel of 5,000 feet. In case this schedule is used passing tracks must be placed at proper points and be moved from time to time as the shovel moves. A diagram similar to that used in making time tables on a railroad is an easy way to determine the location of these sidings. Fig. 1 shows the method.

In this figure, horizontal lines are spaced two minutes apart and each fifth one is made heavier and the figures given to show the time represented. The vertical lines are spaced 1,000 feet apart, the one marked 0 being at the shovel. It is assumed that it takes fifteen minutes to load a train and three minutes to unload. The first train in the morning is No. 1, the second No. 2 and the third No. 3. The trains all move past the shovel in one direction only and in order to do this the empty track joins the loading track 500 feet ahead of the shovel. The solid inclined lines show the trains moving at six miles per hour out to the dump 4,900 feet, stopping there three minutes, then going back at six miles per hour 2,400 feet to a piece of 3 per cent. grade 1,200 feet long, a speed of five miles per hour is assumed here, then at six miles per hour for 1,800 feet to the junction with the loading track 500 feet ahead of the shovel, then back to near the shovel at the same speed where a wait is made of about six minutes for the shovel to complete loading the previous train No. 3. The dotted line shows that if No. 1 was

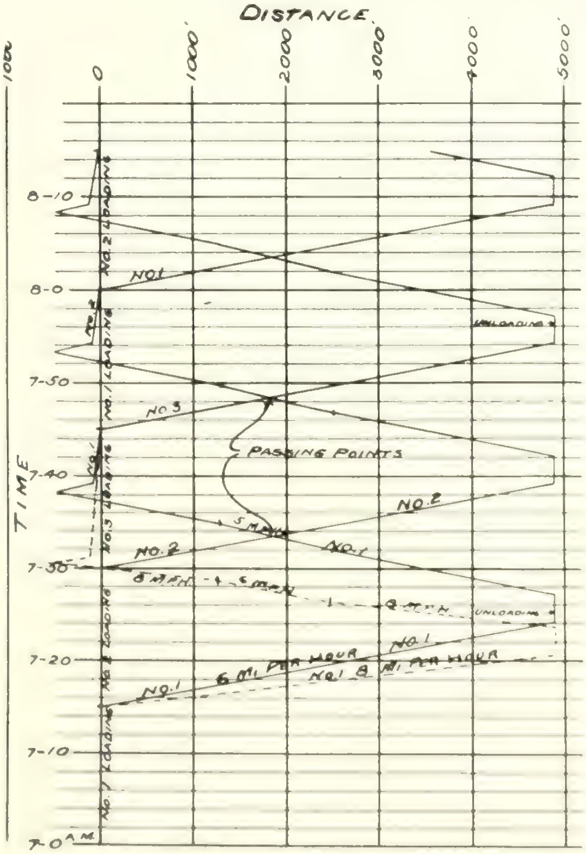


Fig 1

[illegible] at eight miles per hour over the favorable grades and six miles per hour over the unfavorable ones, that it would arrive at the shovel only about one minute too late to start loading as soon as the shovel finished loading No. 2. This minute of lost time would decrease the output about 80 cubic yards per day. A speed of over 10 miles per hour would be required to bring No. 1 to the shovel in time to start loading as soon as No. 2 was loaded and this is too fast time to figure on.

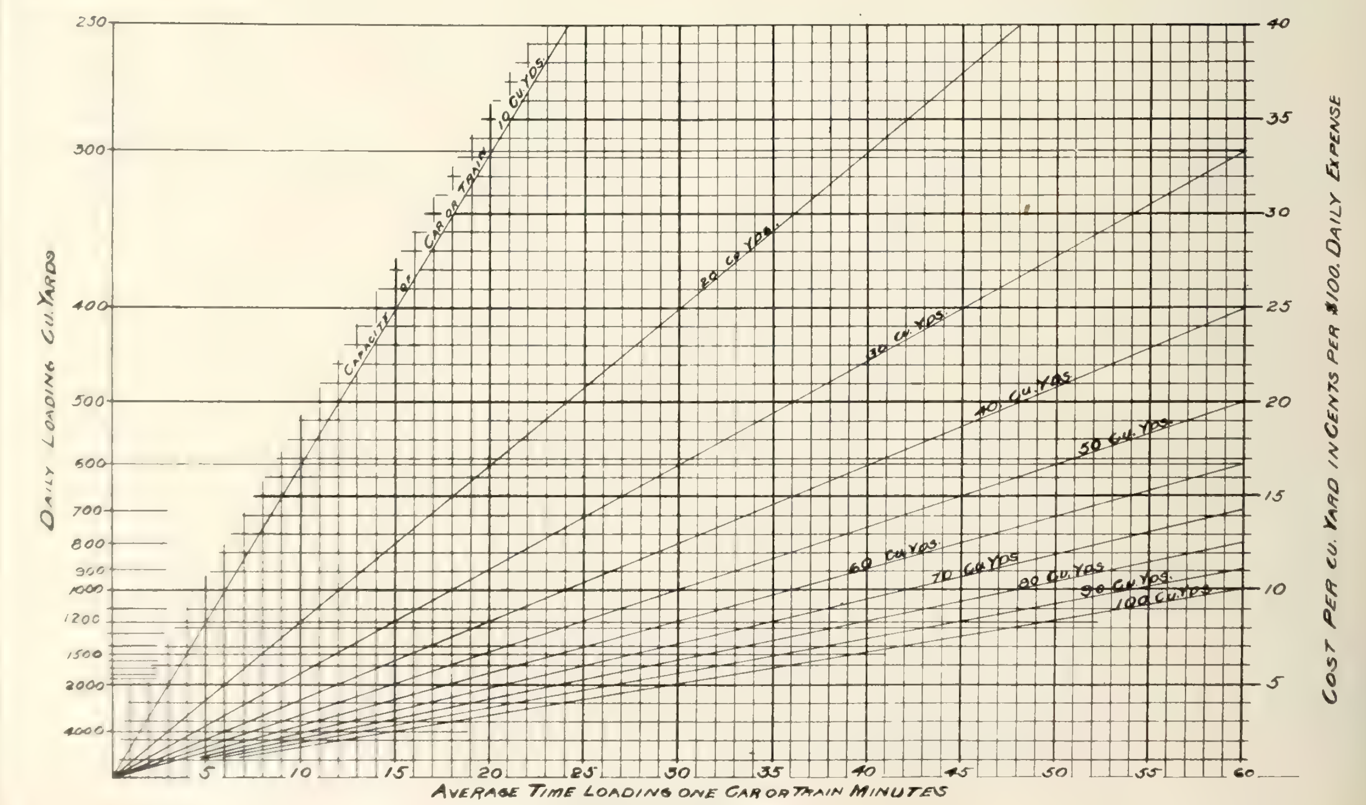
It is generally better to make some allowance for delays and put on more trains than the schedule calls for where the tracks are poor. If the conditions are such that the track can be maintained in good condition and grades are light, a higher speed can be assumed and a less number of trains. It is best to keep close watch on the conditions, using a watch to take the time required to load a train and see that there are trains enough to meet the conditions. The fact that cars are always there to be loaded keeps up the enthusiasm of the shovel crew. All the above is predicated upon having a shovel crew which knows how and is willing to get the best out of the machine.

The cost and output diagram is very handy in determining what is the best thing to do in regard to trains, their number and cost.

The vertical lines on this diagram are spaced one minute apart, every fifth one being made heavier and marked 5-10-15, etc. They give time required to load one unit. On the right of the diagram the horizontal lines are spaced one cent. apart, the even five being made heavier and marked. They represent the cost per cubic yard in cents for each $100 daily expenditure. On the left of the diagram, the horizontal lines are spaced to show the quantity loaded daily in cubic yards. The diagonal lines are drawn to represent the number of cubic yards loaded in each unit in any given number of minutes at the cost shown on the right and the number of yards per day shown on the left. These lines are drawn for each 10 cubic yards from 10 to 100. To find any intermediate quantities, interpolate along the horizontal lines and draw lines through the origin. It will be noticed that along the horizontal line representing the 600 cubic yards per day output, there are ten even spaces between each of the diagonal lines making it easy to make any interpolation above this line. Below it the 1200 cubic yard line has five spaces between the diagonal lines. To use this diagram, suppose we have 20 cubic yard trains and the average time it takes to load a train is 9 minutes and the daily expense is $95. Along the bottom of the diagram find the vertical line from 9 and follow it up to the 20 cubic yard line. It intersects this 20 cubic yard line at 7.5 cents on the right hand scale and 1,330 cubic yard on the left hand scale, the amount loaded is 1,330 cubic yards per day and the cost is $\frac{7.5 \times 95}{100} =$ 7.1 cents per cubic yard.

Fig. 2 shows the profile and layout of a cut of 150,000 cubic yards, with overhaul figured only on material placed in embankments amounting to 1,200,000 cubic yards overhauled 100 feet. There is also an item of 37,400 cubic yards which, according to the specifications is to be paid for as borrow, which can be hauled from the cut. It is figured that 25 to 30 per cent. of the cut will be classified as loose rock but will require no blasting and there will be 40,000 cubic yards of waste upon which no haul will be paid. It is required to figure the cost of doing the work. In order to do this we will lay out the work and figure the work according to Fig. 2. We will figure that a part of the cut at "A" will be taken out wide enough to lay a double track, narrow gauge railway on the grade "B-C" about 3 per cent. grade and a fill made at "D" on a 4 per cent. grade far enough out from the center line of the railway that the outside track will not be disturbed during construction and will be used as an empty train track and be extended and connected with the loading track after each cut is made.

The first steam shovel cut will be on the grade "D-E,"



Cost and Output Diagram.

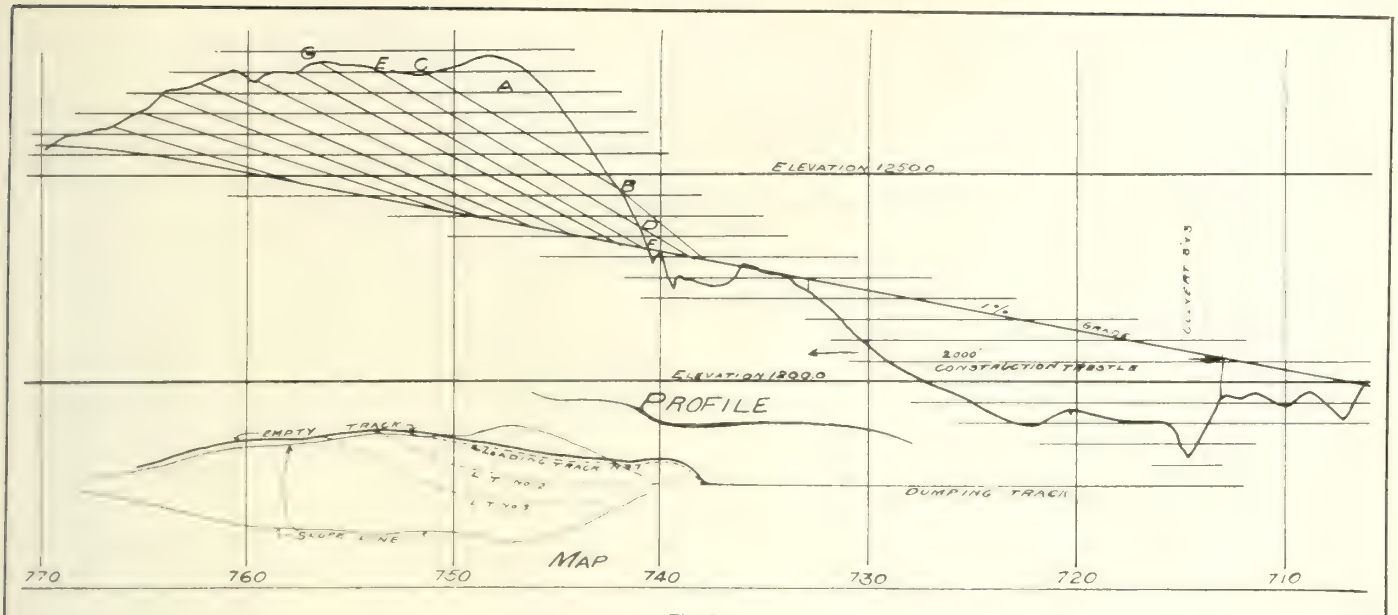


Fig. 2.

the second on the grade "F G." each cut being taken on the next lower grade line as shown. The material at "A" will be taken out by the use of an elevating grader and wagons and will cost 15c per cubic yard. 12,000 yards will be removed but only 10,000 will be taken from the roadway section and paid for. This leaves 140,000 cubic yards for the shovel to move. A shovel of the size to be used on this work should handle 800 cubic yards per day and will take 175 working days to do the digging. It will move back eight times, say four days lost time. As there are 40,000 cubic yards of hard material, this will delay the shovel by cutting its capacity down to about 600 yards per day while in this material, adding 15 more working days and allowing 15 per cent. for bad weather and repairs and other delays, the shovel will be in the pit about 226 days. Moving the shovel onto the job is very difficult and will cost $1,200 and take ten days so the rent of the shovel should be for 236 days and the cost of the excavation would be as follows:

Shovel Expense

Moving shovel onto job	$1,200.00
236 days shovel rent at $8.00	1,888.00
226 days' work with shovel, including foreman, men, coal, oil, etc., at $35.00	7,910.00
Shovel expense	$10,998.00

As the price of loose rock is generally about twice the price of earth, we will call the yardage for the purpose of figuring unit cost 180,000 cu. yds., making the cost per cubic yard 6.1c.

In addition to shovel work the payment for the excavation includes 500 feet free haul on all material and dumping the same as well as trimming and completing the embankments and preparatory work. The cost of this preparatory work and dumping is as follows:

2,000 feet of trestles at $1.50	$3,000.00
8 men 226 days at $2.00	3,616.00
1 foreman 226 days at $3.50	791.00
12,000 cu. yds. moved by grader	1,800.00
Cost	$9,207.00

Cost of preparatory work and dumping per cu. yd. of excavation 6.6c.

Study of the haul shows that three trains will be needed for the longest haul and as they will be in use most of the time, three trains will be charged out in this example as great accuracy in the resulting cost is not intended but as an illustration of methods. The cost of hauling is found thus:

3 trains for 226 days at $14.00 each	$9,294.00
10 men on the track 226 days at $2.00 ...	4,520.00
1 foreman on track 226 days at $3.00 ...	688.00
Getting plant on the ground	700.00
Rent of track and cost of ties and spikes— .	1,200.00
Total cost of haul	$15,402.00

	cu. yds. 100 ft.
Pay for overhaul as above amounts to	1,200,000
Free haul 140,000 by 500 feet	700,000
Haul paid for as borrow 37,400 by 22	823,000
Total amount of haul to be paid for	2,723,000
Dividing the total cost of haul by its total amount gives the cost of haul per cu. yd. per 100 ft. ...	0.6c
A fair contract price	0 [illegible]

To Assemble

The cost of free haul included in excavation charge.	3.0c
Shovel cost	6.1c
Preparatory and dumping cost	6.6c
Total cost of earth work	15.7c
A fair contract price would be	18.0c

And the 37,400 cu. yds. which was figured as hauled beyond the required limit and for which the payment would be made as if borrowed cost 22 x 0.6 = 13.2c per cu. yd.

The cost of loose rock excavation will be:

Shovel cost x 2	12.2c
Preparatory and dumping cost	6.6c
Hauling cost plus 10 per cent. [illegible] [illegible] small	[illegible]
Total cost of loose rock	[illegible]
Fair contract price	21.0c

The loose rock cost is figured in a somewhat arbitrary manner as the data are usually incomplete. The location of loose rock in the cut is unknown and its very existence is unknown until it is encountered.

The other various items are to be taken up in detail in the same way and the prices worked out, the whole to be tabulated as shown and an average cubic yard price worked out to cover each classification of the grading estimate.

All other kinds of work must be taken up in the same way to arrive at estimating prices.

The haul on material required for the various parts of railroad construction is an item which is more apt to be neglected than any other whether the haul is made before track is laid, during track laying or after it has been laid. For instance, take the material used in the track; if the line is 100 miles long and all track material is delivered at one end of the line, the average haul on this material is fifty miles. The aggregate weight of material with 60 lb. rails and an allowance of 10 per cent. for spurs and sidings is 30,600 tons and the ton mile haul is 1,530,000 ton miles, this will cost at least 0.6c per ton mile making a charge at this rate of $9,200 against the item of track laying or nearly $100 per mile and as the length of line increases the train haul on material of all kinds becomes more important.

A mistake made by many engineers and contractors is the neglect of the item of plant rental or depreciation, or the minimizing or misunderstanding of this item. It would take but little work in accounting to get close figures on plant rental and depreciation. By plant is meant all machinery and appliances which, from their character, are expected to last longer than one season and which are more or less general in their use. These should be charged to a special account when purchased and each job on which they are used should be charged a per diem rental for their use. In estimating on any job, plant rental should be estimated the same as any other item. Special machinery which is bought or built for special jobs andwhich is not applicable for other use should be charged out to this particular job. Hand tools should be charged out to the job for which they are purchased and an allowance for them should be included in every estimate. They should be charged in each case to a special account so that when the job is completed their cost can be ascertained. In the plant account, each item of plant should be numbered and all heavy repairs charged to it and all plant rental credited. Ordinary repairs made by the blacksmith or machinist on the job should not be charged against the plant account but all purchases of repair parts should appear in the plant account.

In the absence of special knowledge of the depreciation of each item of plant which would be derived from a plant account, a good rule for figuring plant rental for any particular job is to charge 5 per cent. of the new cost of each item of plant per month to the job. This seems to indicate that the anticipated life of the item in question would be 20 months of actual service which is rather short for most items but it means in actual practice about five seasons' work when annual overhauling, repair parts and winter storage costs are taken into consideration. This is close to the actual fact as annual overhauling costs increase with the age of the unit and if the machine is to be kept in thoroughly efficient condition, these costs will accumulate and keep pace with the rental charge.

Overhead charges are of two classes: General and Job. The general overhead charges consist of office expenses of the general office, bidding costs and other items of similar nature relative to the general office, and may be figured on the basis of all work done by the contracting company and added to the job overhead.

Job overhead consists of interest on money required to meet payrolls and pay for materials bought and stored for use on the work, cost of bonds required by the contract, cost of liability, insurance, cost of job office, and salary and expenses of walking boss, superintendent, and all general utility men employed for the job as a whole. It should not however, include the wages of men employed in the general commissary store or any expense in connection with the store, as the profit on the goods sold should cover this item. Job overhead should also include cost of construction of roads and trails, cost of freight on equipment to the nearest point to the work reached by a common carrier and cost of headquarters camp buildings so far as they are to be used for the general administration of the job, also the cost of general storage yards or buildings for the storage of material for the job where the same are not for special use and capable of being distributed directly to any item of the work. These items should be kept as low as possible by charging out all expenses possible to the proper item of the work and should be estimated as a lump sum and reduced to a percentage of the cost of the job. This job percentage together with general percentage completes overhead charges. Having arrived at the overhead percentage of the cost of the work as above, this percentage should be added to the cost of each item to get its total cost. This cost plus a percentage for contractor's profit gives a bidding price or cost to the owners.

While a railroad has been taken as a basis of this article, the aim has been simply to illustrate the method of figuring basing prices fitting the actual conditions rather than guessing at them, although the latter is by far the most general way. The unit cost of projects of similar nature but in different locations will be different on account of differing labor conditions, hauling roads, frieght rates and other surrounding conditions. There is no way to find out how much difference these conditions should make in costs except by using the conditions in detail estimates in the general manner illustrated in this article.

At Winnipeg the contract to erect a new warehouse for the Ames-Holden-McCready Company has been let to the Lyall, Mitchell Company, at about $100,000. The building will be six storeys high, of mill construction, brick and stone. The architect is Mr. J. D. Atchison.

A quarry of variegated marble is reported to have been discovered on the south fork of Kaslo Creek, B.C. The material is said to be suitable for mantlepieces and statuary, also for ornamental stock such as tiling, wainscotting, brackets., etc. About $300,000 have been invested in plant and machinery.

Messrs. William C. Edes and Thomas Riggs, Jr., and Lieut. F. C. Mears, were appointed recently by President Wilson members of the Alaskan Railroad Commission, which will have charge of the location of railways to be built in Alaska under the act appropriating $40,000,000 for that purpose.

At Cornwall, Ont., the Glengarry Construction Company, Montreal, has received the general contract for the construction of the entire St. Polycarp Junction-Cornwall line of the Glengarry & Stormont Railroad. The work will include 275,000 cu. yds. of earth and 10,000 cu. yds. of rock excavations, 300,000 cu. yds. of embankment, 320 ft. of steel, and about 7,200 cu. yds. of masonry. Mr. C. L. Hervey is the engineer.

In connection with the prospective award of contracts for the construction of the proposed bridge over the Second Narrows, B.C., a modified scheme on the previous alternative bid submitted with the tenders on the Wolfe-Barry designs has been outlined by Mr. C. A. P. Turner on behalf of the Western Foundation Company, Toronto. The two next lowest tenderers, the Dominion Bridge Company and the Canadian Bridge Company, are to be given the opportunity to submit bids on the Turner design. This provides for a structure of the same width and accommodation, and follows the general lay-out of the British engineers' plans. The longer span will avoid piers in the deepest part of the channel, provide a wider fairway for small boats and afford less resistance to the tides. The substitution of reinforced concrete caissons for steel cylinders is proposed.

Personal Mention

Mr. C. D. McArthur has been appointed general manager and chief engineer of Foley Bros., Welch, Stuart & Farquier, of Halifax, N.S.

Mr. Archibald Currie, city engineer of Ottawa, who recently had a severe nervous breakdown, is, we are glad to learn, well on the road to recovery. He has been in Atlantic City for some time.

Sir. Jos. Wilson Swan, inventor of the first incandescent electric lamp, died at London, Eng., on May 27, aged 86 years. He was born at Sunderland, Eng., and was the inventor of many other electrical devices, including a miner's safety lamp and an electric meter. At one time he was the president of the British Institution of Electrical Engineers.

Mr. G. D. Archibald, who, as announced in our issue of May 6, has been appointed City Engineer of Saskatoon, Sask., is an Associate Member of the Canadian Society of Civil Engineers, and has been for the last two years engaged as contractors' engineer on pavement work in Canada and the eastern States. He was also for a short time on Section 2 of the new Welland Ship Canal at St. Catharines. Mr. Archibald began his engineering life in 1900 as rodman, draftsman, etc., for the Nova Scotia Steel and Dominion Iron and Steel companies in Nova Scotia. He then went to the Grand Trunk Pacific in Western Canada on location and construction work, and later, from 1907 to 1912, was engineer in charge of maintenance and construction for the Canadian Northern Railway.

Mr. L. B. Merriam, C.E., Winnipeg

Mr. L. B. Merriam, consulting engineer, Winnipeg, whose article, "Estimating the Cost of Earthwork and Concrete Construction," is a feature of this issue, was born in the State of Connecticut in 1860. Graduating from the University of Illinois he served in the engineering departments of several railways in various capacities on location or construction work. In 1890 he entered the service of the Chicago and North-Western Railway and soon became Assistant Division Engineer, a capacity in which he remained until 1896, when he opened an office in De Kalb, Ill., and became engaged in general consulting engineering. During the years following he carried out a number of important commissions for large railroads in the United States. Mr. Merriam came to Canada in 1906 and shortly afterwards was appointed Division Engineer of the Grand Trunk Pacific, with headquarters at Winnipeg. Three years later he established an engineering office in Winnipeg. He has had charge of several important undertakings and has acted in an advisory capacity on contractors' estimates and equipment. During all the years from 1890 until the present time, Mr. Merriam's work has been largely the organization and direction of labor forces employed directly by the companies represented.

Mr. L. B. Merriam, Winnipeg

Mr. Richard Carter Dancy, Pioneer Toronto Contractor

One of Toronto's pioneer contractors is Richard Carter Dancy, whose specialty is plastering. He was born in Sussex, Eng., in 1852 and came to Canada at an early age. He was educated in Toronto and learned his trade in that city. Afterwards he went to the United States and worked in the principal cities on the other side of the border for twelve years. He returned to Canada in 1883 and carried on a contracting business with his brother under the firm name of Dancy Brothers. During this time he was Managing Director of the Toronto Pressed Brick & Terra Cotta Company. He has been engaged in his present line of business about seven years and has completed some of the largest plastering contracts in Toronto. His work includes: the Traders Bank, the Toronto General Trust Building, the Royal Alexandra Theatre, the Bank of Toronto, the new Y. M. C. A., and the Bishop Strachan School, all in the Queen City. Mr. Dancy's military connection is worthy of note. He served with the 10th Royal Regiment for ten years and saw active service during the Fenian Raid.

Mr. R. C. Dancy, Toronto.

Hon. Angus McDonnell, of the firm of Grant, Smith & Company and McDonnell, Limited, contractors for the construction of the concrete piers in connection with the extensive harbor scheme at Victoria, B.C., has returned to British Columbia after his recent marriage.

Mr. W. C. Brennan, formerly secretary of the Hamilton board of works, was recently appointed Commissioner of Public Works and Streets at Fort William, Ont.

Messrs. W. F. Stanley & Company, Limited, 286 High Holborn, London, Eng., are the sole manufacturers and patentees of a patent Swivel Nib Drawing Pen, which draughtsmen will find a valuable acquisition. The improvement on the older forms of drawing pens is considerable, as the nibs can be opened out instantly for cleaning and replaced afterwards without interfering in any way with the original adjustment and the thickness of line.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

The new plant of the Mount Royal Brick Company, Limited, at Varennes, Que., will be in operation early in June

The Hamilton, Ont., city council are considering the installation of an over-flow sewer system at a cost of $500,000. A. F. Macallum is city engineer.

Solid rock has been struck at a depth of 85 feet as a result of boring tests made for the foundation of a proposed high level bridge at St. Catharines, Ont.

At Fort William, Ont., the site for a new armoury, at a cost of about $180,000, has been selected. Contracts will be let shortly for the building which will be constructed this year.

The Building Department at Montreal has been reorganized and a number of new appointments made. The salary of Mr. Alcide Chausse, building inspector, has been raised from $2,500 to $4,000.

Hyslop Bros., of Dundas, Ont., have decided to establish their western Canadian headquarters in Regina. The firm has secured temporary quarters in the city warehouse, but will erect a substantial building in the near future.

Work on the new government road from Lennoxville, Que., to Derby Line is going on rapidly. Mr. Darey, engineer to the contractors, Messrs. Doheny & O'Brien, expects to have the entire twenty-four miles completed by next year.

About one thousand men are at work with six steam shovels and eight locomotives on the construction of the railway from Woodstock, N.B., to St. John. About 120 miles of the line between Gagetown and Centreville will be completed this year.

The city of Westmount, P.Q., has decided on an open competition for plans for the new City Hall. Premiums of $150 each will be given to four architects whose plans are selected by the adjudicators, Mr. F. S. Baker, of Toronto, and a committee appointed by the Council.

Recent reports from Fort William indicate that the mining industry is becoming active in that locality. Important discoveries of minerals north of the city were made recently by Professor F. Von Hille, mineralogist, who is said to have secured samples of gold, nickel and platinum.

Seventy residences, estimated to cost $210,000, are to be erected in the city of Quebec by Henry Gaffney, 204 St. James Street, Montreal, who is the owner, architect and general contractor. Operations will be commenced about July 1, when tenders for the several trades will be received.

The City Council of Toronto have come to an agreement with Messrs. Hazen & Whipple, the New York engineers who prepared plans some time ago for a duplicate slow sand-filtration plant at Toronto Island. The firm presented a bill amounting to $32,335, but have now agreed to accept $10,800.

Thirteen grain elevators have been purchased by the N. M. Paterson Grain & Elevator Company, Fort William, Ont. These elevators, which were formerly owned by the Royal Elevator Company of Winnipeg, will be operated in conjunction with the terminal elevator at present in use by the Paterson Company.

The Mount McKay Products, Limited, manufacturers of pressed and common brick and clay products, were reorganized recently at Fort William, Ont., under a new charter, with a capital of $500,000. The plant is situated at the foot of the mountain where shale is obtained by gravity, and four new brick kilns are in course of construction.

Foundation work for the Old People's Home, which is to be erected at St. Laurent, Que., at a cost of $250,000, has been completed. The owners are the Order of Grey Nuns and the general contractors the Atlas Construction Company, Belmont Street, Montreal. The building will be three storeys high, 200 ft. by 80 ft. in dimensions, of reinforced concrete construction.

A contract for the erection of a new Rosemount school for the Montreal Protestant Board of School Commissioners has been awarded to Messrs. A. F. Byers & Company, Limited. The contract price is $121,000. Messrs. Nobbs & Hyde, Montreal, are the architects. The same firm of contractors are building a new dry cleaning house and boiler house for the Toilet Laundry Company, from designs by Hutchison, Wood & Miller, Montreal.

At Stratford, Ont., Mr. Davis Barnett, a member of the Stratford Water Commission which visited the waterworks convention at Philadelphia, U.S.A., this month, has issued a report dealing with several of the most important water filtration plants in the United States. He announces that all the large filters that have been installed in the states in the last three years are some form of the quick-acting mechanical type of filter adopted by Stratford.

The Ontario Government is actively engaged in the work of road construction throughout the province, a six-mile stretch of macadam road work having been completed recently at Fort William, Ont. Another six miles will be added to the same road and it is said that a road extending from Fort William to the International boundry line, a distance of 42 miles, will be cut this year. The Ontario government is working in conjunction with the government of the United States for the building of an automobile highway between Duluth and Fort William.

WESTERN CANADA

Building permits at Regina, Sask., for the first half of the month of May amounted to $350,000.

At Prince Albert a by-law to raise $250,000 for a street railway system is to be submitted to the ratepayers.

A clay products plant is to be erected at Le Pas, Man., by The Pas Clay Products Mining & Development Company, which is capitalized at $50,000.

The plans for the $250,000 sewer system that the council of Redcliff, Alta, will submit to the ratepayers in June, have been received from Mr. W. J. Francis, C.E.

Foundation work is in progress for the $300,000 temple which is to be erected at Cardston, Alta., for the Church of Latter-Day Saints. The architects are Messrs. Pope & Burton, Salt Lake City.

At Medicine Hat, Alta., the contract has been let to Messrs. Geo. H. Archibald & Company, Limited, contractors, Winnipeg, for the construction of a mill for the Maple Leaf Milling Company. Work on the new plant will be started almost immediately.

The Winnipeg Board of Control has awarded contracts for the making of pavements at approximately $200,000. Mr. H. N. Ruttan is the engineer in charge of the work, which is being carried out by the general contractor, Mr. J. W. Astley, Superintendent of Construction.

The hotel to be erected at Regina, Sask., for the Grand Trunk Pacific Railway, at a cost of over $1,000,000, will be completed in August, 1915, according to an announcement made by Mr. Morley Donaldson, vice-president and general manager of the company.

The Vancouver Portland Cement Company and the Bamberton Cement Company have secured the contract for 100,000 barrels of cement for the concrete cribs in connection with the pier construction scheme at Vancouver.

Calgary ratepayers have approved a by-law authorizing the expenditure of $512,600 for the erection of a concrete bridge and a steel bridge over the Bow River and a concrete bridge over the Elbow River. The City Engineer is Mr. Geo. Craig.

The new sanitary plumbing by-law being prepared by the Sanitary Inspectors' Association of Western Canada will contain a clause providing for reducing the height of the sewer ventilation shafts above the roofs of buildings, in order to eliminate trouble caused by ice caps on the ventilation terminals.

The Alberta Town-Planning and Housing Association will convene at Calgary, Alta., June 16-18 next. Precedence will be given to the consideration of the proposed housing bill for the province of Alberta. The Mawson plans for the city of Calgary, as well as civic plans for the various cities of the Dominion, will be on exhibition. The proceedings will be opened by the Lieutenant-Governor of Alberta.

A new Pantages theatre which was opened a few days ago at Victoria, B.C., by Sir Richard McBride, Premier of British Columbia, has a seating capacity of 1,000. The building is of steel and concrete construction and involved an outlay of approximately $150,000. The proscenium opening is 32 ft. in width, while the stage proper is 28 ft. in depth and 58 ft. from side to side. The main entrance to the building is semi-circular in shape, with rich marble panelling on the walls. The "sprinkler" system of fire protection is installed with four hundred automatic fusible spraying heads. Mr. Jesse M. Warren was the architect, the contractors being the British Columbia Construction & Engineering Company.

Canadian Railroad Development

The province of New Brunswick has secured government aid to the extent of $3,000,000 for the construction of three bridges for the St. John River Valley Railway. The entire cost will be borne by the Dominion government. After a period of fifteen years a rental based on the proportion of the cost of the bridges to that of the whole line will be charged. Of the three bridges one will be built at Andover, the second near Dunn's wharf, and the third across the Kennebecasis River.

The Canadian Pacific Railway has erected seven gates that will be operated automatically by electricity, to safeguard traffic across its tracks along the Vancouver water front. The gates are of the portcullis type and will be raised or lowered by pressure of an electric button. The company will expend seven million dollars this year in double-tracking its line between British Columbia and western points. In addition it will expend about eleven millions on similar improvements in Eastern divisions.

It is announced that the Western Dominion Railroad will construct a line down the valley from Calgary, Alta., to the oil fields. Instead of building one hundred miles of road as was at first intended, the line will be carried south to the International boundary, there to be met by a branch of the Chicago, Milwaukee and St. Paul line, now building from Great Falls. The road has been financed by a joint syndicate of London and New York capitalists, and the work will be commenced immediately.

At Amherst, N.S., a good deal of bridge work is to be carried out this year on the Intercolonial Railway. Over one hundred steel bridges will be strengthened so as to accommodate heavy power from Truro to River du Loup, and contracts for over forty have already been let to various bridge contracting companies in Canada. The Rhodes Curry Company, of Amherst, have been awarded contracts by the Dominion government for nine girder bridges. The steel to be used in these will be imported in channels and fabricated at the Amherst shops of the Canada Car & Foundry Company.

Sixty steel and wood bridges, ranging from seventy-five to one hundred and twenty-five feet in length, will be required in a distance of eighteen miles on the Central Canada Railway north of Edmonton, for which route plans have been filed with the Provincial Department of Railways for Alberta. Engineers report that at least 50,000 yards of earth will have to be removed from every mile of line on the roadway along the North Hart river, and that the cost to construct this stretch of line will be more than $50,000 a mile or $30,000 a mile in excess of the bonded obligation of the provincial government. It is the intention to span the Peace river with a steel bridge at a cost of $400,000, thence the line will continue to Dunvegan, along the north bank of the Upper Peace river.

International Engineering Congress, 1915

Among the general subjects to be treated before the International Engineering Congress (San Francisco, September 20-25, 1915), probably the one having the broadest interest is that of Materials of Engineering Construction, which enters into all phases of engineering activity.

The list of topics which will be treated in this section is as follows: (1) Timber. (2) Preservative Treatment of Timber. (3) Substitutes for Timber in Engineering Construction. (4) Brick in Engineering Structures. (5) Clay Products in Engineering Structures. (6) Probable and Presumptive Life of Concrete Structures made from Modern Cements. (7) Aggregates for Concrete. (8) Slag Cement. (9) Waterproof Concrete. (10) Cements containing Additions of Finely Ground Foreign Material. (11) Economics of the World's Supply of Iron. (12) The Life of Iron and Steel Structures. (13) The Employment of Special Steel in Engineering Construction. (14) The Place of Copper in the Present Engineering Field, and of Economics of the World's Supply Thereof. (15) Alloys and Their Use in Engineering Construction. (16) Aluminium in Engineering Construction. (17) The Influence of the Testing of Materials upon Advances in the Designing of Engineering Structures and Machines. (18) Cement Testing. (19) Testing of Metals. (20) Testing Full-Sized Members. (21) Proof Testing of Structures.

The papers to be presented from the United States have already been arranged for from the recognized leading authorities on the various topics. Arrangements for the papers from foreign authors are being rapidly concluded, and the aggregation of papers which will be presented will constitute a broad review of the field and be of the highest value.

Marked interest in the Congress from foreign countries continues, and there is every evidence that the attendance from abroad will be large. It is hoped that all engineers in this country who have not yet subscribed as members of the Congress will give the matter their immediate attention and favorable action.

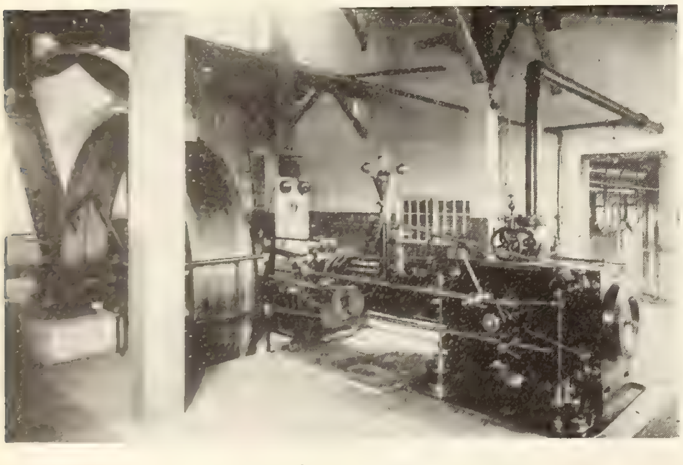
Full information concerning the Congress, the price of subscription, and the arrangement for purchase of volumes of the proceedings, may be obtained by addressing the Committee of Management, as follows: International Engineering Congress, 1915, Foxcroft Building, San Francisco, Cal.

Plant and kilns of the National Builders' Supply & Enamel Concrete Brick Company, Limited, at Mascouche, Que.

An Up-to-date Plant for the Manufacture of Enamelled Concrete Brick

Erected and Equipped at Mascouche, Que., by the National Builders' Supply & Enamel Concrete Brick Company, Limited, Montreal

In this age of concrete, one hardly needs reminding of the durable qualities of that material. The problem of manufacturing it into brick form and of facing it with an enamel finish has been the subject of many experiments, it being recognized that if successfully solved, the product would be a brick of great permanent characteristics. The result of several years' experiments and the expenditure of a large sum of money was the invention of the machine made by the Enamel Concrete Brick Company, Des Moines, Iowa. The bricks have been extensively used in the United States, and are now being manufactured in this country by the National Builders' Supply and Enamel Concrete Brick Company, Limited, of 30 St. Francois Xavier Street, Montreal, at Mascouche, P.Q., who hold the exclusive rights for Canada. The capital is provided by a Franco-Belgian syndicate, and it is intended to erect about ten plants throughout the Dominion. For that purpose several machines have been ordered, and the company are also negotiating for the right to install the machines in Europe.



View of engine room.

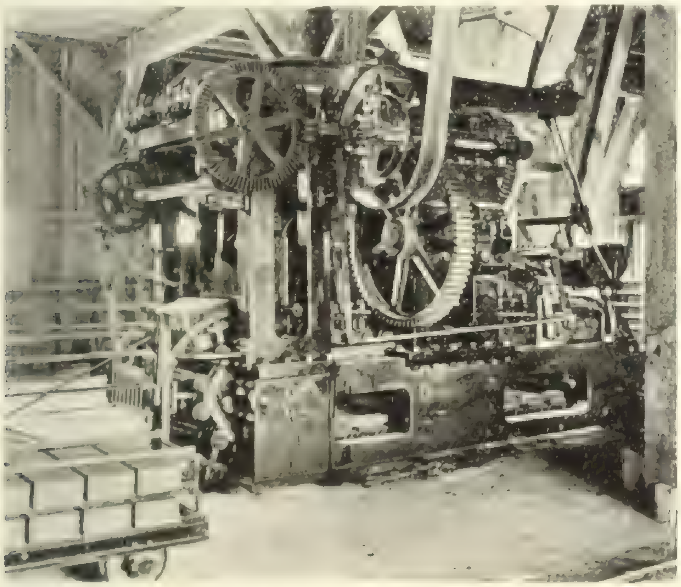
The plant at Mascouche, 26 miles from Montreal, has just been installed from the design, and under the superintendence of Mr. H. C. Harding, the managing director. The company own 147 acres of land yielding a very fine sand, well adapted for manufacturing the brick; it is composed of felspar and quartz—practically a pure silica sand. An option on an additional 600 acres is held by the company. The bricks are composed of sand and cement, and are made either in the form of enamel, pressed, or moss finish, and in fifteen standard shades, although any desired color can be obtained. It is claimed that they are fireproof, waterproof, sanitary and artistic, and can be adapted to every use to which building stone or brick can be supplied.

The works comprise a mill, oil-house, camp, storeroom and offices, engine-house, forge fitted with a complete equipment for repairs, and a laboratory and testing room.

The mill is strongly built of lumber, and is capable of extension; in fact it will be shortly enlarged to allow of the installation of another machine. One of the features is the automatic action of the entire machinery, hand labor being eliminated wherever possible. The sand is conveyed to the ground floor, where it is fed into an American Process dryer; this machine is 6 ft. in diameter and 42 ft. in length and rotates at 6 revolutions per minute. When dried the sand falls into a boot and is elevated to the third floor, where it passes over a screen, the stones being thrown into a shoot at the side. As the coarse sand passes into a bin it can be screened a second time by an ingenious screen, the idea of Mr. Harding, controlled from the floor below. Should this finer sand be required, a lever is pulled and the sand, instead of going into the sand bin on a conveyor, passes over a smaller screen and into a spout leading to the next floor. On the third floor is situated the bin for the cement, to which this material is elevated from the second floor, where the bags are hoisted direct from the railway cars. The materails stored on the top storey pass down to the next room as they are wanted, the supply being regulated by the man in charge of the mixing machine. The responsibility for the smooth running of the mixing, etc., rests upon this employee, who controls the quantities of materials coming from the bins, the moisture of the mixture, and the regularity with which the materials are fed into the press on the ground floor. Near him is fixed a card dial, with various directions as to the mixture and the running of the machines; this is connected with the press on the ground floor, and if any more moisture is required, the men at the press signal by means of the dial and the alteration is made. After the cement and sand have been mixed and a certain amount of water added to give the right consistency, the mixture flows into eight individual scale hoppers, thus automatically measuring the materials for each brick. These hoppers automatically dump the material through receiving spouts leading into the eight moulds of the press below. This press is very heavily built, and weighs 36½ tons. The eight moulds are subjected to a pressure of 3,200,000 pounds, forming the material into strong hard bricks, which are delivered from the machine eight at a time. This is the method of manufacturing the common concrete brick.

When an enamel face is required, an additional process comes into operation. On the second floor there are the color vats for mixing whatever color is desired. The liquid drops into a series of eight cups attached to the press on the ground floor; these cups automatically deposit the liquid into the moulds, which then receive from a mixer on the second floor a special mixture of fine sand and cement, this deposit acting as a cushion on top of the liquid enamel facing. The remaining portion of the moulds are filled by the body or backing material of which the common concrete brick is made, and which has been delivered to the press as described in the preceding paragraph. The mould boxes are subjected to the heavy pressure referred to, which unites and amalgamates the facing cushion and backing materials into one cohesive mass for each of the eight bricks.

The bricks are released resting on the steel pallets on which they are made. There are 14,000 of these polished pellets, which after being used are oiled and cleaned by a special machine erected near the press. The latter has a capacity of 35,000 to 40,000 bricks per day. On the ground floor there are also two hand machines for making special bricks.



Brick press machine

After coming from the press, the bricks are placed on folding deck cars—of which there are 125—and conveyed on rails to the four steam curing tunnels, each 140 feet long. Here the bricks are subjected to a high pressure for 24 hours, and later transferred to the loading sheds ready for shipment. The steel cars are of very ingenious construction, and permit of a minimum of handling. Four additional kilns are now being built.

The mill is about half a mile from the railway station, and the C. P. R. have put in a special siding, which allows railway cars to be loaded from both sides of the sheds, which have a capacity of seven million bricks.

The boiler house and engine room is an exceptionally well-lighted and spacious department. The boilers, manufactured by the Goldie and McCullough Company, Galt, Ont., are two in number, and each of 125 horse-power. They are coal fed, forced draught being provided by a ten horse-power upright engine and by a blower made by Sheldons, Limited, Galt. In the boiler house is a National feed water heater fed by a Blake duplex feed pump 6 x 4 x 6. The tank in the mill is fed by a duplex pump supplied by the Smart-Turner Machine Company, of Hamilton. The engine, of 200 horsepower, is by the Jenckes Machine Company, Sherbrooke, P.Q.

The plant is electrically lighted, there being 200 lights in all, with 1¼ miles of wire. The engine is the Ideal, while the d.c. generator, 115 volt, 60 amp. and 1,800 r.p.m. was manufactured by the Canadian General Electric Company, who also supplied a small lighting panel. All the refuse oil is filtered by a Simms oil filter.

Water is supplied from a reservoir with a capacity of 80,000 gallons, which serves the double purpose of draining the land and giving an ample supply of water for the plant; it is very pure, being filtered through the sand. It is pumped direct into the boilers and into a large tank at the top of the building. Near the reservoir is a platform for loading sand for the Montreal market, this platform having a capacity of 25 cars per day.

A large amount of the iron and accessories for the building were supplied by the Canadian Fairbanks Morse, Limited, Montreal; the conveying apparatus by the Jeffreys Manufacturing Company; and the belting by the J. C. McLaren Belting Company, Montreal.

Baystate Brick and Cement Coating

The concrete contractor who has had difficulty in waterproofing his buildings will appreciate the merits of Bay State Brick & Cement Coating as manufactured by Wadsworth-Howland & Company, 82-83 Washington Street, Boston, Mass., and described in their Booklet 10. This booklet contains a great many photographic reproductions of buildings in which this waterproofing has been used, together with a long list of buildings in practically every state in the Union. It also contains a color card showing the various colors in which it can be obtained and from which practically any desired shade can be made. The object of Bay State Brick & Cement Coating is to decorate and protect concrete, cement, stucco and brick surfaces. It overcomes the dull, monotonous color of ordinary Portland cement, and prevents such surfaces from showing any spots, blotches, discoloration or dampness after a storm. By filling all of the pores in the surface, it prevents air cracks and other disfigurations. When metal lath is used with stucco, this compound prevents any moisture getting to the lath and so prevents the deterioration of it. By excluding dampness, it preserves all of the building materials, as well as insures a dry inside wall. Bay State Brick & Cement Coating can be used not only on the exterior but on the interior, where it gives the soft, velvety effects of water color. As it is unaffected by dampness, it has far greater durability than any other of the products used for this purpose, and it can be washed without injury. It is one of the few compounds which bears the label of the National Board of Fire Underwriters, and when used for wood tends to lessen the fire risk.

An illustrated catalogue of Iroquois road and street paving machinery and tools received from the Barber Asphalt Paving Company, Buffalo, N.Y., is suggestive as to the possibilities of this equipment. The various lines shown and described include tandem rollers, macadam road rollers, portable heating kettles, double drum dryers, semi-portable bituminous mixing plants and asphalt and concrete mixers. The company also has a line of small tools which, in common with Iroquois machinery, are the outcome of twenty five years' experience in the manufacture and use of equipment for paving and road building.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Berlin, Ont.

The city council has decided to install a filtration plant at Shoemaker's Dam, as the Board of Health has forbidden the further use of the water until a plant is erected.

Brocket, Alta.

Tenders will be received by Duncan Scott, Dept. of Indian Affairs, Ottawa, until noon June 8th, for excavating, concrete work, wood and galvanized iron piping and valves connected with the installation of a waterworks system for the Peigan Reserve. Plans and specifications are at the Indian Office Brocket, Post Offices at MacLeod and Lethbridge, and at the office of Woods & Steel, Civil Engineers, Pincher Creek, Alta.

Brockville, Ont.

Estimates are being prepared by the town council for the construction of tarvia roadway on King St. W., from Kingston Bridge to the town limits, and for the paving of Church Street, from Perth Street to the C. N. R. station.

Esquimalt, B.C.

Plans are being prepared for the construction of the third unit of the sewer system. The municipal council will call for tenders in the near future. Engineer, C. H. Topp, 211 Pemberton Blk., Victoria.

Hamilton, Ont.

The question of the construction of an overflow sewer system, at an estimated cost of $500,000, will be brought up by Ald. Littlewood at the next meeting of the city council.

London, Ont.

Plans are being prepared for the paving of King St. The cost is estimated at $8,000.

Moncton, N.B.

The town council are having plans prepared for extensions to the sewerage system.

Montreal, Que. (Pt. St. Charles)

Tenders will be received by L. N. Senecal, secretary to the Board of Commissioners, until noon, June 12th, for the construction at the low level pumping station, Pt. St. Charles, of a brick building, with concrete foundations and fireproof roof, etc., as per plans and specifications at the office of the Superintendent of Waterworks, City Hall.

Montreal, Que., St. Lambert

Tenders will be received by the engineer, E. Drinkwater, for the next two weeks, for the laying of sidewalks on 15 streets.

Niagara Falls, Ont.

Tenders will be received by the city council clerk, W. J. Seymour, or the engineer, F. J. Anderson, until noon June 30, for the construction of approximately 4,390 lin. ft. of 8 and 10-in. sanitary sewers. Plans are at the office of the Engineer, City Hall.

Orillia, Ont.

By-law providing for the remodelling of the waterworks system at a cost of $80,000 will be submitted to ratepayers on June 18th.

Ottawa, Ont.

The assistant city engineer, F. C. Askwith has been requested to report on the road equipment and machinery required by the city, so that the purchase can be made.

The laying of the following pavements is being considered by the city council. Macadam tarvia finish on Carling St., between Bank and O'Connor Sts.; asphalt pavement on O'Connor St., between Laurier and Lewis Sts.; treated wood block on Chapel St., between Anglesea Sq. and St. Patrick St.; wood block on Murray St., between King and Chapel Sts., and wood block on York St.

Port Moody, B.C.

A by-law providing for the construction of a reservoir and water supply system at a cost of $66,000 is to be submitted to the ratepayers. The water supply will be obtained from Noon and Scott Creeks. The engineers are Davis & Leslie of Vancouver.

Prince Rupert, B.C.

The Board of Works has recommended the laying of a 10-in. watermain in Sec. No. 2, a 6-in. main on 7th Ave., and a 6-in. main on 6th Ave. The total cost is estimated at $21,000.

Regina, Sask.

New tenders are to be called for the construction of a reservoir at Dewdney and Broad streets. The previous tenders were rejected owing to the change of location. Engineer, J. M. Mackay, Supt. of Waterworks.

Revelstoke, B.C.

The construction of pavements on various streets is being considered by the city council.

The city council has decided to construct cement walks on 3rd and 4th Sts.

Shellbrook, Sask.

The village council has received the permission of the Provincial Government to raise the sum of $2,500 for improvements to the sidewalks, streets and municipal buildings.

Truro, N.S.

The town council has decided to construct certain concrete pavements and sidewalks at a cost of $5,750. The work is to be done by day labor.

Toronto, Ont., Weston

Tenders will be called shortly by the town council for the construction of a new road on Main St., 1¾ miles long.

Victoria, B.C.

The city council has approved the paving of Cook street from Mears street to Rockland Ave. and Fairfield Road between Dallas Road and the city limits.

Vancouver, B.C.

The construction of the following sewers has been recommended by the engineer, F. L. Fellowes, on Garden Drive, $15,000; Lakewood, $3,560; 4th Ave., $2,670; 3rd Ave., $1,350; 2nd Ave., $1,265; Broadway, $1,100; 8th Ave. E., $2,600; 8th Ave., lane, $1,250.

Yarmouth, N.S.

The town clerk, Hiram Goudey, will be glad to receive prices on rock crushers, for road building purposes.

CONTRACTS AWARDED

Assiniboia, Man.

The rural municipality of Assiniboia has awarded to A. C. Vanhorenbeeck & Co., of St. Boniface, the contract for the construction of a sewer on Ness Ave.

Camrose, Alta.

The contract for sewer and waterworks extensions has been awarded by the municipal council to Chas. Gray, Prospect Ave.

Edmonton, Alta.

The following contracts for watermains and sewers have been awarded by the city council. McMahon & Graham, $80,000; C. L. DeVall, $53,000; Ross & McCabe, $33,000.

Montreal, Que., St. Lambert

The town council has awarded to E. Belanger Co., of 2820 St. Hubert St., Montreal, a contract for sewer construction.

Point Grey, B.C.

The municipal council has awarded to Robt. McLean & Co., of Vancouver, the contract for the sewer extensions on 48th Street.

Prince Albert, Sask.

The city council has awarded to The Red Wing Sewer Pipe Co., of Red Wing, Minn., U.S.A., a contract for the supply of 40,000 ft. of 15-in., 12-in., 10-in., 8-in., 6-in. and 4-in. sewer pipe, with unctions and specials.

Sherbrooke, Que.

The city council has awarded to J. S. Mitchell & Co., 73-77 Wellington St., a contract for the supply of 6-in. cast iron pipe, at $30.15; 8-in., at $30.15; 10-in., at $30.15; fittings, at $54.

Toronto, Ont.

The Board of Control has awarded contracts for various works to following: concrete sidewalks—Routly & Summers, 38 Benlamond Ave.; Queen City Concrete Paving Co., 179 Broadview

Ave.; A. J. Penberthy, 292 Booth Ave.; International Contractors, Ltd., 2261 Yonge St.; A. Johnson, 35 Burgess Ave.; The Commissioner of Works; Riverdale Concrete Paving Company, 256 Jones Ave. Grading:—J. L. Boyd, 84 Victoria St., Queen St., $756; Patterson St., $969; Merrick St., $1,355; Glendale St., $2,068. Asphalt pavements:—Commissioner of Works—Agnes St., $9,092; Wellington St., $15,421; Gadgerow Ave., $4,402; Hugo St., $1,806; Seymour St., $5,524.

The following contracts have been transferred from the Commissioner of Works: Asphaltic Concrete Co., King St. E., rocmac macadam pavements on Avondale Ave., $2,126. Concrete sidewalks to following:—R. J. Moyes & Co., 592 Gerrard E.—Birrell Ave.; H. Mitchell, 464 Brock Ave.—Conduit St.; A. Johnson, 35 Burgess Ave., Beryl Cres.; Queen City Concrete Paving Co., Broadview Ave., Frichot St.; Routly & Summers, 38 Benlamond Ave., Baby Point Rd., Elmer Ave.; Grant Contracting Co., 50 Front St. E., Ashworth St., Arlington St. Asphalt pavements: Constructing & Paving Co., Confederation Life Bldg.: Concord Ave., $3,059; Dupont Street, $6,655; Armoury St., $3,271; Newsham St., $1,665; Sunnyside Ave., $6,337. Sewers:—John Maguire, Davenport Road, sewer on Dupont and Shaw streets, $8,650; Routly & Summers, 38 Benlamond Ave., Patterson Ave., $760.

The following sewer contracts have been awarded by the Board of Control. Patterson, Veitch & Watson, Robins Bldg., Belhaven, $1,098; Burgiss, $1,800; Cassels, $959; Hiawatha, $64; Kingsmount, $1,704; Walpole, $392. McKnight **Construction Co., 88 St. David Street, Oedarvale, Iona, $788; Keystone, $2,633;** Kingswood, $1,119; Oakcrest, $895. H. A. Robinson, 17 Woodlawn Ave., Devon Rd., $989; Golfview, $1,900. Grant Contracting Co., 50 Front St. E., Dewson St., $360. Routly & Summers, 38 Benlamond St., Patricia, $1,740. Frank Angotti, 1155 Davenport Rd., lane off Dundas St., $675. Commr. of Works, Midway System, $18,500, and following streets, 8th, 5th, 3rd, 2nd, Terauley, Sherwood, Eihelwin and 7 lanes.

The Board of Control has awarded the following pavement contracts. Britnell Contracting Co., 309 Davenport Road, brick block on Eastern Ave., $41,977; A. J. Penberthy, 292 Booth Ave., lane south of King St., $1,695; Commr. of Works, rocmac on Sheridan Ave., $3,420; lane off York St., $1,455.

Wolfville, N.S.

A contract for the laying of tarvia pavement has been let by the town council to Carritte, Paterson Co., of St. John, N.B.

Windsor, Ont.

The following contracts have been awarded in connection with the watermains extensions: General contract, B. Oldani & Co., Royal Bank Bldg.; pipe, Gartshore-Thomson Pipe & Foundry Co., of Hamilton, at $31.50 per ton.

Railroads, Bridges and Wharves

Bowmanville, Ont.

The C. P. Rly. Board of Commrs. have approved of the location of a site on Wellington Street for the erection of freight sheds and work will be started shortly.

Brighton, Ont.

Tenders will be received by R. C. Desrochers, Public Works Department, Ottawa, until 4 p.m. June 24th, for the renewal of the present wharf and extension to same. Plans, etc., are at the offices of the Dist. Engineers, Confed. Life Bldg., Toronto, Windsor, Ont., Postmaster Brighton, and at the Department, Ottawa.

Hamilton, Ont. (Dundas)

The construction of a bridge is being considered by the town council. Chairman, Board of Works, John Douglas.

Lang, Sask.

Tenders will be received by F. J. Robinson, Board of Highway Commrs., Regina, until June 8th, for the construction of 2 reinforced bridge abutments over Moose Jaw Creek, near this point. Plans and specifications are at the office of the Public Works Department, Parliament Bldgs., Regina.

Langenburg, Sask.

Tenders will be received by F. J. Robinson, Board of Highway Commrs., Regina, until June 8th, for the construction of a reinforced sluiceway for the dam. Plans and specifications are at Public Works Department, Parliament Bldgs., Regina.

Larchwood, Ont.

The Canadian Pacific Rly. Board of Commrs. have aproved of the location of a station at Larchwood, Twp. Balfour, Sudbury Dist., Ont.

McTaggart, Sask.

Tenders will be received by F. J. Robinson, Board of Highway Commrs., Regina, until June 8th, for the construction of reinforced concrete bridge and dam north of McTaggart. Plans and specifications are at the office of the Public Works Dept., Parliament Bldgs., Regina.

Province of Manitoba

Tenders will be received by M. Chisholm, secretary to the municipality of Langford, County Bldg., Neepawa, until June 5th for the construction of a reinforced concrete bridge over Stoney Creek between sections 26 and 35-14-16. The authorities will furnish cement and steel on cars at Hannel Siding, two miles distant, and gravel can be secured at a distance of three-quarters of a mils. Plans and specifications are at the office of the Highway Commissioner, Winnipeg, and at the office of the sec.-treas.

Province of Ontario

Tenders will be received by the engineer, Frank Barber, 57 Adelaide St. E., Toronto, until noon, June 9th, for the construction of concrete beam bridge over Holland River on town line between above counties north of Schomberg, known as Brown's Bridge.

Tenders will be received by J. E. Farewell, County Clerk, Whitby, Ont., or the engineer, Frank Barber, 57 Adelaide St. E., Toronto, until noon June 3rd, for the construction of concrete abutments for two 40-ft. steel bridges between the counties of York and Ontario.

Ottawa, Ont.

Plans for alterations to the Wellington St. viaduct have been drawn and approved by the Board of Control.

Peterboro, Ont.

Tenders for the construction of Sec. No. 3 Trent Canal, Severn Division, will be received by L. K. Jones, Dept. Railways & Canals, Ottawa, until June 18th. Plans are at office of the Chief Engineer, Ottawa, the Supt. Engineer, Peterboro, and the Dist. Engineer, Midland.

Regina, Sask.

The Grand Trunk Pacific Rly. proposes to construct a subway connecting the G. T. P. Hotel with the railway station and to carry heating system conduits.

Ringold, Ont.

The Canadian Pacific Rly. has decided to erect a station on Lot 8, Can. 3, Twp. Raleigh, Kent County, Windsor Sub-Div., Ont.

St. John, N.B.

Tenders will be received by the city clerk, H. E. Wardroper, until June 9th, for the construction of a concrete retaining wall at Victoria Sq. Specifications are at the office of the Commr. of Public Works.

Toronto, Ont.

The York County Highway Commrs. have decided to erect a new bridge near Concord and one near Agincourt.

CONTRACTS AWARDED

Vancouver, B.C.

The contract for the erection of a wharf at Burrard Inlet has been awarded by the Imperial Oil Co. to Beers, Ltd., 301 Rogers Bldg.

Victoria, B.C.

The following sub-contracts on the wharf and dock construction have been let by the general contractors, Grant, Smith & Co. and McDonnell, Ltd., Vancouver: cement, Vancouver Portland Cement Co., and the Bamberton Cement Co.; rubble rock, Deep Cove Quarries, Burrard Inlet, Vancouver.

Public Buildings, Churches, Schools, etc.

Buckingham, Que.

Tenders will be received by E. F. Gorman, sec.-treas., to the School Board, until noon, June 8th, for the construction of a school building on the 4th concession, Twp. of Buckingham.

Chatham, Ont.

Tenders will be called shortly for a 4 room addition to Forest St. School.

Edmonton, Alta.

Plans have been completed and tenders will be called shirtly for the addition of a new wing to the Royal Alexandra Hospital.

Hamilton, Ont.

The congregation of St. James Anglican church, Ottawa St., propose to erect a new church. Options on several sites have been secured. The chairman of the building committee is Geo. C. Copley, 63 McNab St. N.

Mr. W. Witton, 7 Hughson St. S., has been appointed architect in connection with the proposed additions to Christ Church Cathedral.

Hanover, Ont.

Plans for the erection of an armory building, at a cost of $30,000, are being prepared by the Public Works Department. A suitable site is being selected.

Humboldt, Sask.
Tenders will be received by Earnest Brown, Public Works Department, Regina, until June 5th, for the erection of a court house. The estimated cost is $70,000.

Joliette, Que.
Tenders for alterations to the post office will be received by R. C. Desrochers, Public Works Department, Ottawa, until June 22nd. Plans are at the office of the Supt., Post Office, and R. L. Deschamps, Dom. Bldgs., Montreal. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto, Ont.

Kenora, Ont.
Plans for the erection of a public library have been drawn by John Manuel, of 3 Ludlow Court, River Ave., Winnipeg. The specifications are about completed, and tenders will be called in the near future.

Tenders for the construction of a fish hatchery will be received by Alex. Johnston, Dept. of Marine & Fisheries, Ottawa. Plans and specifications are at the Post Offices at Kenora, Fort William, Ont., and Selkirk and Winnipeg, Man., and at the Department, Ottawa.

Melville, Sask.
Tenders for the erection of a school building for the Separate School Board will be received by the architect, J. H. Rudy.

Tenders for the erection of a hospital for the St. Joseph's Hospital Board will be received by the architect, J. H. Rudy, Melville, after June 15th. The specification calls for a main building and five wings, each 4-storeys, brick and steel construction, to accommodate 150 beds.

Merrickville, Ont.
Tenders for extensions to drill hall will be received by the Director of Contracts, Dept. of Militia and Defence, Ottawa, until noon, June 4th. Specifications are at the office of Officer Commanding 3rd Division, Kingston, Town Clerk, Merrickville, and Director General of Engineer Services, Headquarters, Ottawa.

Moncton, N.B.
Plans for the erection of a church and parsonage for the St. Johns Presbyterian Church Congregation are being drawn by H. G. Jones, of Stanley St., Montreal, who will call tenders shortly.

The city engineer, Jno. Edington is preparing plans for the erection of the market building on East Market Street.

Mount Brydges, Ont.
The Mt. Brydges Agricultural Society propose to erect a fair building.

Montreal, Que.
The addition of a storey to the city hall is being considered by the Board of Commissioners.

Montreal, Que., Pt. Aux Trembles
The tenders for the erection of the new school for the R. C. School Commrs. were received, but the prices were too high. New tenders will be called shortly.

Montreal, Que., St. Laurent
It is probable that the infants' home proposed by the Grey Nuns, Guy and Dorchester Sts., will not be built this year.

Montreal, Que., Verdun
The Verdun Athletic Club has purchased a site on Church Ave. for the erection of a club house. The architect will be appointed shortly.

Montreal, Que., Westmount
It is understood that the Grey Nuns Western Ave. Hospital will not be built this year.

Ottawa, Ont.
Plans for the erection of a church, Sunday School and parsonage, for the St. Paul's Lutheran Church Congregation, are being prepared by W. E. Noffke, 405 Plaza Building.

Peterboro, Ont.
A site on Mark and Hunter streets has been purchased by the Mark St. Methodist Congregation. The building will not, however, be erected at present, probably not till next year.

Regina, Sask.
It is understood that the erection of the police station on 10th Ave. has been postponed. Frid Lewis & Co., McCallum Hill Bldg., are the general contractors.

Shediac, N.B.
Work on the erection of the R. C. church will be done by day labor, under the supervision of Julien Cormier, of this town.

Sorel, Que.
Tenders now being received by the School Commrs., St. Joseph de Sorel, for a large addition to the convent.

Stamford Twp., Ont.
Tenders will be called shortly for the erection of a gymnasium for the Stamford High School. C. M. Borter, of Niagara Falls South, is the architect.

Sudbury, Ont.
Tenders for the erection of a school building for the Separate School Board, will be received by the Sec. of Board, S. Fournier, until 6 p.m. June 10th, to be marked as follows: (1) tender for masonry, carpentry, etc.; (2) tender for heating; (3) tender for plumbing; (4) tender for electric wiring; (5) tender for painting. Plans are with P. J. O'Gorman, Sudbury. Architect, Wm. H. Owens, 18 Baikie-Gill Block.

Turner Siding, Alta.
Tenders for the erection of a building will be received by the architect, Chas. Hay, 210 Oddfellows Block, Calgary.

Toronto, Ont.
Funds are being raised to erect a chapel building in connection with the new Bishop Strachan School now under construction.

It is proposed to increase the seating capacity of Calvary Baptist Church, Gerrard St. E.

Plans for the addition to St. Johns Anglican Church, Norway, are being altered. The building is to accommodate 800, and will be of brick construction. Architect, C. D. Lennox, 164 Bay St.

The Aura Lee Club, 205 Avenue Rd., has purchased a property of 10 acres, east of Yonge St., near Mt. Pleasant Road. Golf links, tennis courts, athletic grounds will be laid out and club buildings erected. Dr. S. Wollatt, 3 College St., is interested in the project.

The Royal Astronomical Society, 195 College St., is negotiating with the city for a site on Bathurst St. for the erection of an observatory.

The congregation of the Wychwood Church of Christ propose to erect a new church on Helena Ave.

Victoria, B.C.
The architect, J. C. M. Keith, 416 Sayward Bldg., has been instructed to prepare specifications and invite construction tenders for the erection of a jail on Fishguard St.

Vancouver, B.C.
Tenders for the erection of a postal station at Mt. Pleasant, will be received by R. C. Desrochers, Public Works Dept., Ottawa, until June 22nd. Plans are at the office of A. C. Hope, architect, 603 Hastings Ave., Res. Architect, Wm. Henderson, Victoria, Postmaster, and at the Dept., Ottawa, Specifications are at MacLean Daily Reports, Ltd., 220 King St. W .,Toronto, Ont.

Tenders for the erection of a drill hall will be received by R. C. Desrochers, Public Works Department, Ottawa, until June 29th. Plans are at the office of Perry & Fowler, Vancouver, Res. Architect, Wm. Henderson, Victoria, and at the Dept., Ottawa. Specifications are at MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Detailed plans for the erection of a high school gymnasium building are now being prepared by Bldg. Supt. Giles, and tenders will be called as soon as possible.

Windsor, Ont.
The erection of a masonic temple on McDougall St., at a cost of $15,000, is being considered. Isaac Nolan, 259 McDougall St., and Geo. Smith, 153 Wyandotte St. E., have been appointed on the building committee.

Weyburn, Sask.
Permission has been granted by the Provincial Government to Weyburn School District No. 512, to raise the sum of $25,000 for school purposes.

CONTRACTS AWARDED

Compton, Que.
The town hall has been let by the municipality of Compton to P. Parsons, of Moe's River, Que.

London, Ont.
The Charlotte St. school contract has been awarded by the Board of Education to J. Moran & Sons, 557 Dundas Street.

The Tecumseh Ave. High School contract has been let by the Board of Education to J. Moran & Sons, 557 Dundas Street.

Moncton, N.B.
The following contracts have been awarded in connection with the erection of the nurses' home on St. George St. Dominique LeBlanc, St. Anslem, Moncton. Painting, Allan McDonald, Downing St. The contract for heating, plumbing, electrical and interior fittings is not let yet.

Montreal, Que.
The sub-contract for carpentry in con-

nection with the renovations of St. James Club, Dorchester and University Sts., has been let to Geo. Roberts, 79 Lagauchetiere W. The other tenders are in and contracts will be awarded shortly.

Montreal, Que. (St. Henry)
The contract for the erection of parish church has been awarded to R. Labergs, 141 Convent Street, St. Henry, who has also secured the school and residence contract.

Montreal, Que., Longue Pointe
The fire and police station contract has been awarded by the Board of Commissioners to E. N. & U. Boileau, Longue Pointe.

Port Coquitlam, B.C.
The following additional contracts have been awarded in connection with the erection of the City Hall: ornamental stone, Hynes Stone & Staff Co., 1128 Homer St., Vancouver, $1,800; heating and plumbing, Coquitlam Hardware Co., Pt. Coquitlam.

Port Coquitlam, B.C.
The city hall contract has been awarded by the city council to C. Davies, at $15,965.

Pugwash, N.S.
The general contract for the erection of the school has been secured by B. M. Mattinson, of this town. No sub contracts are let yet.

Rock Island, Que.
The contract for additions to the fire hall and tool storehouse has been awarded by the town council to the local firm of Morrill Bros.

Regina, Sask.
The contract for the erection of a school on 14th Ave., for the Gratton R. C. School Board, has been secured by Wilson & Wilson, Westmann Chmbrs.

Swift Current, Sask.
The contract for the erection of the court house has been awarded by the Public Works Department to J. Lecky Co., Ltd., of Regina.

Summerland, B.C.
The school contract has been secured by B. C. Footner, of Walhachin, B.C. The building is to be completed by August.

Business Buildings and Industrial Plants

Cobourg, Ont.
The ratepayers have voted a loan of $10,000 to a syndicate in which Geo. W. Charles is interested. The new company will take over the plant of the Cobourg Matting & Carpet Co., and will manufacture felt goods, boots, shoes, etc.

Montreal, Que.
The proposed alterations to the store of Mr. Jacobs, St. Catherine St. W., will not be proceeded with this year.

Montreal, Que., Outremont
Nothing further will be done with regard to the proposed warehouse for Seaman-Kent, Ltd., Durocher St., before July 1st.

North Vancouver, B.C.
It is understood that the Standard Trust & Industrial Co., Ltd., of Vancouver, is now looking for a site on which to establish a mill for re-rolling scrap steel.

Ottawa, Ont.
The erection of a commercial building of 8-storeys is proposed by the Intercolonial Securities Corporation, Ltd., Booth Bldg., Sparks St.

Regina, Sask.
The Petrie Mfg. Co., Ltd., 8th and Rose, has under consideration the erection of a 3-storey warehouse.

The Regina Red Pressed Brick Co. has leased a site for the erection of an experimental plant to test brick and tile manufacturing from Regina clay.

Tara, Ont.
The erection of a general store, at a cost of $7,000, is being considered by C. R. Tobey.

Toronto, Ont.
The erection of a club house was proposed at the annual meeting of the Empire Club. Sec., G. B. Hunt, 232 Jarvis street.

The erection of 2 stores on Pape and Randolph Aves., is proposed by Wm. McEachren & Son, 70 King E.

Plans are being prepared for the erection of a branch of the Dominion Bank on McCaul and Anderson Sts. J. W. Lyle, 14 Leader Lane, is the architect. Tenders will be invited shortly.

Vancouver, B.C.
The proposed addition and alterations to the Orange Lodge building on Hastings St. E., have been postponed. The work may be done next year.

Victoria, B.C.
C. E. Watkins, architect, Green Block, is preparing sketch plans for the erection of an office building for a syndicate.

The Victoria Curling Assn. is having plans prepared for an ice rink. Coates & Fleet, 28 Winch Bldg., are the architects.

Windsor, Ont.
Plans for the erection of store and flats on Pitt and McDougall Sts., for Herman Benstein, are being drawn by G. Jacques & Co., Boug Block. Estimated cost $10,000.

CONTRACTS AWARDED

Hamilton, Ont.
The following sub contracts have been awarded in connection with the erection of store and apartments, on James St. S., for Messrs. Oliver & Barber. Carpentry, J. T. Drake, Beulah Ave.; steel, Hamilton Steel Constr. Co., Lottridge St.; roofing, J. E. Riddle & Son, Ferguson Ave. N.; painting, H. W. Carnes, 187 Cannon St. E.; gas fittings, heating and plumbing, A. Clark, 7 Main St. W.; electrical, L. H. Lauder, 110 King St. W.

Moncton, N.B.
The contract for the erection of a warehouse for F. W. Summer & Co., Main St., has been secured by O. J. Dunham, 2 Fleet St.

Montreal, Que.
The roofigg contract in connection with the alterations to the stores of H. H. Lyman, 369 St. Catherines St. W., has been let to the Standard Roofing Company.

The contract for alterations to the store of Jno. Ivey Co., Ltd., 240 Notre Dame W., has been let to M. Fromson, 68 Colonial Street.

The contract for alterations to the premises of C. C. Cottrell, St. Catherine St. W., has been secured by D. F. Sheehy, 16 St. Cecile St.

Ottawa, Ont.
The contract for addition to the hotel premises of Nap. Lafrenierre, Queen St., has been awarded to W. F. Slack, 95 Flora Street.

The contract for alterations to the premises of W. Cowan, Laurier Ave., has been let to John Ferguson, 643 King Edward St.

St. Catharines, Ont.
The contract for the erection of Welsh & Co.'s factory has been secured by G. Christman & Co., of Hamilton.

Victoria, B.C.
The contract for the erection of a store and apartment building, on Fishguard St., for Tong Ork, has been received by T. H. Brown, 717 Discovery street.

Residences

Caledonia, Ont.
Tenders for the erection of a residenct for W. Leith are invited by the architect, J. H. Housego.

Digby Island, B.C.
Tenders will be received by G. J. Desbarats, Dept. of the Naval Service, Ottawa, until noon June 21st, for the construction of a double residence at the Digby Island wireless station. Plans, etc., are at the office of Dist. Supt., Govt. Radiotelegraph Service, Old Post Office Bldg., Victoria, or at the Radiotelegraph Station, Digby Island, Prince Rupert, B.C.

Eastview, Ont.
The erection of a tenement, on Hanna St., is proposed by A. Brownlee, of Montreal Road.

South Edmonton, Alta.
The University of Alberta proposes to build 3 or 4 residences, to cost about $4,000 each for members of the university staff.

Hamilton, Ont.
Jas. Bryers, Wilson & Gibson Ave., who contemplated the erection of 50 residences on Glendale Avenue has abandoned the project.

Hull, Que.
A syndicate, in which Morrisett & Morrisett, of Dalhousie St., Ottawa, are interested, proposes to erect a number of cottages.

London, Ont.
Plans for the erection of a $5,000 residence, on Richmond St., have been drawn by F. Harley, of the London Lumber Co.

McBride & Gilbert, corner Dundas and Richmond Sts., have been appointed architects for the erection of a 3-storey apartment house on Princess Ave.

(Continued on page 80)

Tenders and For Sale Department

CITY OF KELOWNA, B. C.

Tenders Wanted

Tenders in duplicate for the supply of the following apparatus F.O.B. cars Kelowna, B.C., will be received by G. H. Dunn, City Clerk, up to 12 o'clock noon on **Thursday, June 11th, 1914**:

One—225 B.h.p., Vertical, Two Crank Compound Steam Engine.

One—Feed Water Heater.

One—Independent Air Pump and Jet Condenser.

One—150 Kilowatt, 2300 Volt, Three Phase, 60 cycle, Alternating Current Generator for direct connection to engine.

One—Exciter for direct connection to Generator.

One—Switchboard Panel to match present switchboard.

Deposit cheque of 5 per cent. required.

The lowest or any tender not necessarily accepted.

Specifications may be seen after May 25th, 1914, at the following offices:

Canadian Engineer, Montreal.
Canadian Engineer, Winnipeg.
Electrical News, Toronto.
Electrical News, Vancouver.

or may be obtained from the Consulting Engineer's Branch Office at Vernon, B.C.

C. R. YUILL,
Successor to
Mather, Yuill & Company, Limited,
Consulting Engineer. 20-22

Sealed tenders addressed to the undersigned, and endorsed "Tender for Renewal of present Wharf and Extension to same at Brighton, Ont.," will be received at this office until 4.00 p.m. on **Wednesday, June 24, 1914**, for the renewal of existing Wharf and the construction of an extension to same at the Village of Brighton, Northumberland County, Ont.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Brighton, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular [illegible]

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, May 26, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51207. 22-23

City of Stratford

Sealed tenders, marked "Tender for Sewage Disposal Works," will be received by the undersigned up to **Monday, June 8th, 1914**, at 5 o'clock p.m., for the construction of Sedimentation Tanks and Grit Chambers for Sewage Disposal Works.

Plans and specifications may be seen at the offices of the Canadian Engineer, The Contract Record or the City Engineer.

Forms for Tender and any necessary information may be had from the office of the City Engineer.

The lowest or any tender not necessarily accepted.

A. B. MANSON,
21-22 City Engineer.

Department of Railways & Canals, Canada

Trent Canal

Section 3, Severn Division

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Section No. 3, Severn Division, Trent Canal," will be received at this office until 12 o'clock noon on Thursday, June 18th, 1914.

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa; at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.; and at the office of the District Engineer, Public Works Department, Midland, Ont.

Copies of plans and specifications may be obtained from the Department on the payment of the sum of fifty dollars. To bona fide tenderers this amount will be refunded upon the return of the above in good condition.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of $55,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderers will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary.

Department of Railways and Canals,
Ottawa, 21st May, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—61920. 21-22

Concrete Arched Bridge

Sealed tenders, marked "Tender," and addressed to the Reeve, Township of Glenelg, Priceville, Ont., will be received up to **Friday, June 5th**, for the construction of a concrete arched bridge at lot 32, Con. 2 and 3, N. D. R. Glenelg. Tenders will be opened at the Township Hall, June 6th.

Tenders will be received as follows:—A reinforced concrete arched bridge, 50 feet span, 14 foot roadway. An accepted bank cheque for ten per cent. of contract price, payable to the Treasurer, Township of Glenelg, shall accompany each tender and will be returned on non-acceptance. Council supplies reinforcing.

Plans and specifications may be seen at the office of the Reeve, near Priceville.

The lowest or any tender not necessarily accepted.

THOS. NICHOL, Reeve.

Priceville, May 22, 1914. 21-22

Notice to Bidders

Sealed proposals endorsed "Proposal for Painting Highway Bridge," addressed to H. Baker, City Clerk, will be received at the City Hall, Medicine Hat, Alberta, until twelve (12) o'clock **June 15th, 1914.**

Proposals must be made upon the form for the purpose, and must be accompanied by a certified cheque for ten per cent. (10 p.c.) of the amount of such proposal made payable to the Corporation of the City of Medicine Hat. Cheques will be returned to unsuccessful bidders within three days (not including Sundays) after the award of contract. An acceptable bond will be required for the faithful performance of the work in a sum of twenty-five (25) per cent. of the total amount of the bid.

Proposal forms and specifications may be obtained from, and plans of the structure may be inspected at the office of the City Engineer, Medicine Hat.

The City reserves the right to reject any or all bids.

H. BAKER, City Clerk.

City Hall, Medicine Hat,
May 23rd, 1914. 22-23

Tenders for Steelwork

Sealed tenders addressed to J. B. Cote, Secretary, and marked "Tenders for Provencher Bridge," will be received up to 12 o'clock noon, **Saturday, the 20th day of June**, for supply and erection of the superstructure for the Provencher Avenue Bridge over the Red River between St. Boniface and Winnipeg.

Plans and specifications may be seen and forms of tender obtained at the offices of:—

The City Engineer, St. Boniface, Man.
The City Engineer, Winnipeg, Man.
Contract Record, Toronto, Ont.

Canadian Engineer, Montreal, Que.
Pittsburg Testing Laboratories, Pittsburg.
Engineering News, New York.
Strauss Bascule Bridge Co., Chicago.

All tenders to be accompanied by a marked cheque or bid bond for $10,000.

The lowest or any tender not necessarily accepted.

J. B. COTE, Secretary,

19-23 City Hall, St. Boniface, Man.

Waterworks, New Toronto

Sealed tenders will be received by the Town Clerk of New Toronto, until **Friday, June 12th, 1914**, for the supply and laying of cast-iron water mains, valves, hydrants, etc., and steel water tank; also for the supply of steel intake pipe.

Plans and specifications may be seen at the office of the Engineers, James, Loudon and Hertzberg, Room 205, St. James' Chambers, Toronto, or at the office of the Town Clerk at New Toronto.

The lowest or any tender not necessarily accepted.

GEO. IRONSIDE, Reeve.
GEO. D. SCOTT, Clerk. 22

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, June 9, 1914**, for the construction of a 30-ft. clear span reinforced concrete truss bridge on the townline between the Townships of East Guillimbury and Whitchurch, Con. 4, County of York, known as Pegg's Bridge.

Plans and specifications may be seen at the office of the County Engineer, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER
County Engineer.
Toronto, May 28, 1914. 22

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 15, 1914**, for the construction of a reinforced concrete truss bridge, 45 ft. clear span, with Longford Limestone abutments, on the Scarlett Road over the Black Creek, Lot 13, Con. 5, Township of York, known as Golf Club Bridge.

Plans and specifications and all necessary information may be obtained at the office of the Township Engineer, 57 Adelaide St. E., Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, May 28, 1914. 22

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 22, 1914**, for the construction of a reinforced concrete truss bridge, [illegible] clear span, over the Black Creek, opposite Lot 8, [illegible] Con. 4 and 5, Township of York, known as [illegible] Bridge.

Plans and specifications and all necessary information may be obtained at the office of the Township Engineer, 57 Adelaide St. E., Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER
Township Engineer.
Toronto, May 28, 1914. 22

Concrete Work

Tenders will be received up to noon on June **13th, 1914**, for about 300 yards of concrete work, being pier and abutment for the

AYR BRIDGE

For further information apply to—

BOWMAN & CONNOR,
Civil Engineers.
22-23 Berlin, Ont.

Bridge Contract

Tenders will be received by the undersigned up to five o'clock p.m. of **June 10th, 1914**, for the erection of a concrete, steel reinforced bridge over Saugeen River in the village of Priceville, according to plans and specifications by R. McDowell, C.E.

Plans, etc., may be seen at the office of the Engineer, Owen Sound, or with Wm. Aldcorn, Esq., Priceville, and at the office of the undersigned at Flesherton.

The lowest or any tender not necessarily accepted.

A marked cheque for six per cent. of tender to accompany each tender.

W. J. BELLAMY,
Clerk, Artimesia Township.
May 19, 1914. 21-22

Tenders for School

Sealed tenders will be received by the undersigned up to **June 10th at 6 p.m.** for the erection and completion of a 12-room school building in the town of Sudbury.

Tenders to be marked as follows:

(1) Tender for Masonry, Carpentry, etc.
(2) Tender for Heating.
(3) Tender for Plumbing.
(4) Tender for Electric Wiring.
(5) Tender for Painting.

A marked cheque for 5 per cent. of the amount of the bid must accompany each tender.

The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the office of the Architect, P. J. O'Gorman, Sudbury.

S. FOURNIER,
Secretary Separate School Board,
Sudbury, Ont.
Dated May 26th, 1914. 22

TOWNSHIP OF BRANTFORD

Concrete Sidewalks

Sealed tenders addressed to the Township Clerk, County Building, Brantford, will be received up to 6 p.m. on **Wednesday, the 10th of June, 1914**, for the construction of 38,124 lin. ft. ([illegible] miles) of four foot concrete sidewalks.

The work will be let in two separate contracts as follows:

No. 1 Group comprising 30,243 lin. ft., being composed of all walks north of Grand River Canal.

No. 2 Group comprising 7,881 lin. ft., being composed of all walks south of Grand River Canal.

Tenders must be accompanied by a marked cheque for 5 per cent. of the amount of the tender made payable to the Township Treasurer.

Tenderers are expected to examine the locality before tendering. Plans, specifications and form of tender may be seen at the office of the Township Engineer, Room 4, Temple Building, Brantford, where tender forms may be obtained.

The Council does not bind itself to accept the lowest or any tender.

ALAN MAIR JACKSON,
22-23 Township Engineer.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, June 9th, 1914, for the construction of the following works:

SEWERS

Moore Park Drainage System, Eastern Section. Outlet from Glen Road and C. P. R. to north end of Harper Avenue, via C. P. R., lane south from Ethel Cres., Ethel Cres., reserve strip at east end of Rosehill Avenue, Rosehill Avenue and Harper Avenue.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer), or in lieu of said sureties the bond of a Guarantee Company, approved of as aforesaid. Conditions relating to tendering, as prescribed by the City By-law, must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
Toronto, May 27th, 1914. 22

Plant Wanted

One cu. yd. Concrete Mixer without power. Cu. yd. bottom dump Concrete Buckets. One yd. Clam with 50 ft. boom, stiff-leg derrick and hoist. One 20-ton capacity Guy Derrick or fittings with Hoist and Independent Swinger. Boilers 30 and 60 h.p., also 2 Scows of 400 ton capacity.

McKINNON & HYSLOP,
Room 111, 79 Adelaide St. E.,
Toronto, Ont.
Phone M. 6417. 22

For Sale—Cheap

1 Pony Planer, McGregor & Gourley, 24-in., in good running condition.

I Iron Saw Table, 3 ft. x 5 ft., Ballantyne Tilting Guide.

Box 27, Contract Record & Engineering Review, Toronto. 21-23

WANTED

Live manufacturer's agent to handle entire line of a large electrical manufacturer of power house specialties, on a commission basis. Address, with full particulars, to Box 31, Electrical News, Toronto. 22-23

Engineer Wanted. Resident Engineer required on construction; must be a graduate in engineering [illegible] had not less than one year's experience on City Municipal works in Canada.

CHIPMAN & POWER,
Mail Building,
22 Toronto, Ont.

Residences

(Continued from page 77)

Montreal, Que., Notre Dame de Grace

[illegible] 147 [illegible] Ave., Montreal W., who has the general contract for the erection of a residence for the Hampton Realty Company, will take prices on electrical and plumbing

Montreal, Que., Outremont

Plans have been drawn for the erection of a $8000 residence for A. Claude, rue De L'Epee.

Montreal, Que., Westmount

Turner & Carless, 49 Beaver Hall Hill, have plans in hand for the erection of a [illegible] residence on Rosemount Ave., for [illegible]

Ottawa, Ont.

The erection of a residence, on Arlington St., is proposed by J. H. MacLaren, [illegible] Bay street.

Tenders for the erection of a residence, on Spadina Ave., for Ed. P. Connors, are invited by the architect, F. C. Sullivan, Castle Bldg., Queen St.

C. H. Pinhey, of 110 Welington St., has under consideration the erection of a 4-storey apartment house.

Tenders on the erection of an apartment house, on Laurier and Henderson Sts., are now being received by the architect, F. C. Sullivan, Castle Bldg., Queen street.

The erection of a $6,000 residence on Fifth Ave. is proposed by E. C. Hillman, 349 Frank St.

Plans for the erection of an apartment house on Cooper St., for A. Drazin have been drawn by Jas. Mather, 110 Wellington St.; estimated cost $23,000.

The Intercolonial Securities Corporation, Ltd., Booth Bldg., Sparks St., proposes to erect a 4-storey tenement building.

Prince Albert, Sask.

A permit for the erection of a residence on 18th St. W., has been issued to T. Jackson.

Prince Rupert, B.C.

Plans are being prepared by J. W. Potter for the erection of a 16-suite apartment house.

Quebec, Que., Fairview Park

Plans for the erection of 70 residences have been drawn by Henry Gaffney, 204 St. James St., Montreal. Work is to start about July 1st, when tenders on several trades will be invited.

Regina, Sask.

A permit for the erection of a residence on Angus St., has been issued to W. S. Grey. General contractor, W. M. Calder, 1819 Albert St.

Toronto, Ont.

Tenders on the erection of a residence on Bathurst St. and Eglinton Ave., are invited by W. A. Rumney, 36 Fuller Ave.

The erection of 14 residences on Orchard View Blvd., is proposed by L. C. Sheppard, 17½ Adelaide E., who supplies all material and superintends construction.

Windsor, Ont.

The erection of 5 residences on Erie and Church Streets, is contemplated by Scott & Ray.

Tenders on the erection of a residence on Ouellette St., for Leo. Page, will be received by the architects, G. Jacques & Co., Boug Block, until June 10th.

Westboro, Ont.

The erection of a manse is proposed by the Presbyterian Church Congregation.

Winnipeg, Man.

A permit for the erection of an apartment block, at a cost of $30,000, has been issued to Rubin & Finestein, 682 Alfred Ave.

A permit for the erection of 2 residences on Montrose St., at a cost of $10,000, has been granted to A. J. Anderson, 235 Lenore St.

The Town Planning Assn., Industrial Bureau, propose to erect 2 residences at a cost of $20,000. Architect. H. Edwards, Elec. Railway Chmbrs.

Jas. McDiarmid & Co., Canada Bldg., who have the contract for the erection of a residence, on Ruskin Row and Kingsway, for A. E. Scott, invite tenders for heating, plumbing and electrical.

Winnipeg, Man., Norwood

Tenders on the erection of a $50,000 apartment block are about to be called by the architects, Jordon & Over, Canada Life Bldg.

CONTRACTS AWARDED

Montreal, Que.

The contract for the erection of a residence on Hampton Ave., for Mr. Huot, has been secured by N. Dubuc, Hampton Ave.

Oak Bay, B.C.

The contract for the erection of a residence for Mr. Thornton Fell, of Victoria, has been secured by W. Houghton & Co., of 2 McGregor Block, Victoria.

Ottawa, Ont.

The following contracts have been awarded in connection with addition and alterations to the apartments of James Maloney, 122 Coburg. Masonry, L. Gravelle, 325 Dalhousie St.; carpentry, H. Carey, 73 Waller St. The contract for heating is not let yet.

The contract for the erection of a residence, on Arthur St., for Wellington Bradley, has been secured by J. W. Stanley, 146, Breezehill.

The contract for the erection of an apartment block on Laurier St. West., has been secured by Alexander & Campbell, Bank St.

Sherbrooke, Que.

The contract for the erection of a residence on Victoria St., for Chas. D. White, 16 Court St., has been let to J. W. Clark. No sub contracts are let yet.

The contract for the erection of a residence, on Victoria St., for J. H. Johnston, Lennoxville, has been awarded to Jno. Davey, Fulton Ave.

Weyburn, Sask.

The following contracts have been awarded in connection with the erection of a residence for Dr. H. Eaglesham. General contractor, W. J. Mackley, at $15,600; masonry, C. Carmichael, 8th St.; electrical, David Bros. The contract for heating and plumbing is not let yet.

Power Plants, Electricity and Telephones

Chamberlain, Sask.

Tenders for the installation of a telephone system are invited by F. R. Sanders, secretary to the Chamberlain Rural Telephone Co., Chamberlain.

London, Ont.

The Huron & Erie Loan & Savings Co., 442 Richmond St., are about to install indirect lighting system for which fixtures are required.

The Royal Purple Stock Specific Co., King and Talbot Sts., are about to purchase a 15 h.p. motor for 550 volt, 3-phase, 25-cycle alternating current line.

Saskatoon, Sask.

Tenders will be received by the city commissioners up to noon June 20th, for (a) two four-million gallon, motor-driven, centrifugal pumps with switch panels and starting equipment; (b) one turbine-driven centrifugal boiler feed pump, complete with steam separator, gauges and tools; (c) one 75 kw. motor generator exciter; (d) one 600 kw. rotary convertor and transformers, with switch panels, etc.; (e) three 400 kw. transformers and switch gear equipment; (f) 17,700 ft. 11,000 volt cable partly armoured lead covered and partly lead covered only, and for the laying, jointing and connecting up of same; (g) one mile 2,200 volt, 4-core, 211,600 C.M. cable, and for the installation of same in conduit; (h) 9,000 ft. 500,000 C.M. single conductor double braided weatherproof cable. Specifications, etc., are at the office of the engineer, E. Hanson.

Strassburg, Sask.

Tenders for the installation of a telephone system will be received by V. G. Watkins, secretary to the East Mount Rural Telephone Co., Ltd., Strassburg.

Victoria, B.C.

The city council propose to install cluster lights on Cormorant St., at a cost of $1,840.

Winnipeg, Man.

Tenders will be received by the Board of Control until June 18th, for the supply of globes, electrodes, carbons, cut-outs, etc. Specifications at office of the engineer, J. G. Glassco, 54 King St.

CONTRACTS AWARDED

Colonsay, Sask.

The contract for the installation of a telephone system has been awarded by the local Telephone Company, to the Prince Albert Light Company, of Prince Albert.

Estevan, Sask.

The contract for the installation of a telephone system has been secured by F. Eymann.

Regina, Sask.

The following contracts on the power house equipment has been awarded by the city council. General contractor, Jno. Dolmer, P.O. Box 465, Winnipeg, for brick work for 4 boilers, $4,920; general contractors, Samford-Riley Stoker Co. (agents B. F. Sturtevant Co.), 2-6 retort Riley Underfeed stokers, at $8,900; general contractors, Canadian Fairbanks-Morse Co., 2109 S. Railway St., one 15 h.p. motor driver for economizers and equipment, $486.57.

Miscellaneous

London, Ont.

The following contracts for supplies have been awarded by the city council. Cast iron, Gartshore-Thomson Pipe and Foundry Co., of Hamilton; hydrants and special castings, London Foundry Co. 369 Thames St.; brass valves, etc., Canada Brass Co., Stone Rd., Galt; Empire Brass Co., Dundas St. E., London; Mueller Mfg. Co., of Sarnia; stop cock boxes and Valve boxes, Vulcan Co., Ltd., 84-94 Fullarton St., London; gate valves, T. McAvity & Sons, Ltd., Toronto.

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Danville Brick Co.	Danville, Ill.
Wabash Clay Co.	Veedersburg, Ind.
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Alton Brick Company	Alton, Ill.
Deckman-Duty Brick Co.	Cleveland, Ohio.
Tuna Valley Pressed Brick Co.	Bradford, Pa.
Foster Paving Block Co.	Bradford, Pa.
Metropolitan Paving Brick Co.	Canton, Ohio
Bessemer Limestone Co.	Youngstown, Ohio
Peebles Paving Brick Co.	Portsmouth, Ohio
Southern Clay Mfg. Co.	Chattanooga, Tenn.
The McAvoy Vitrified Brick Co.	Philadelphia, Pa.
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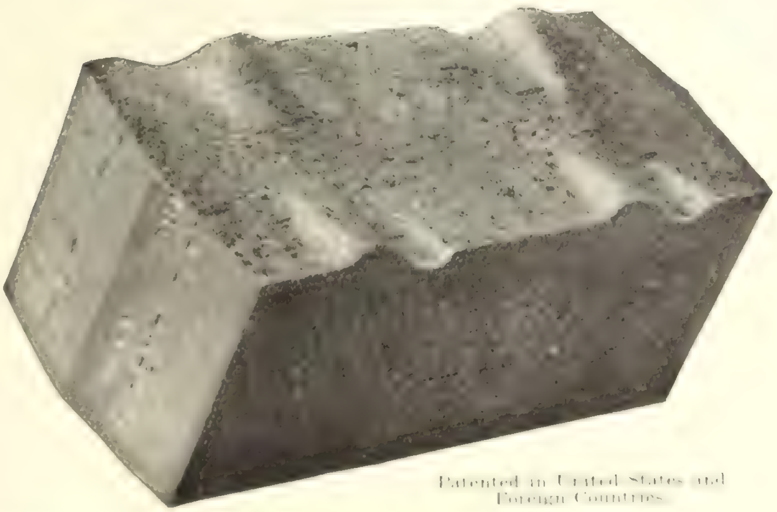

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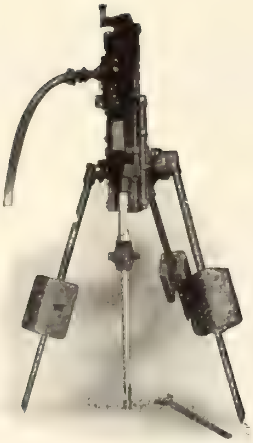

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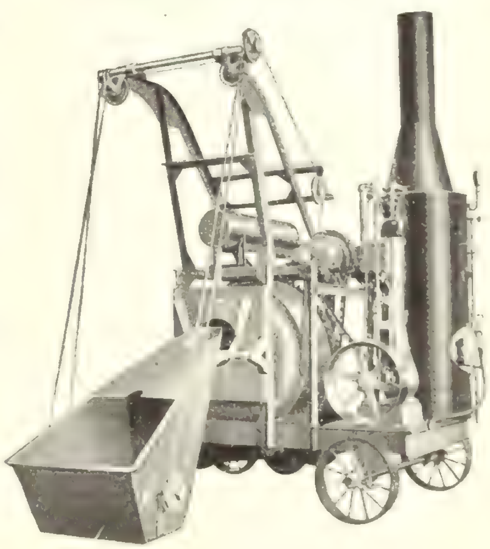

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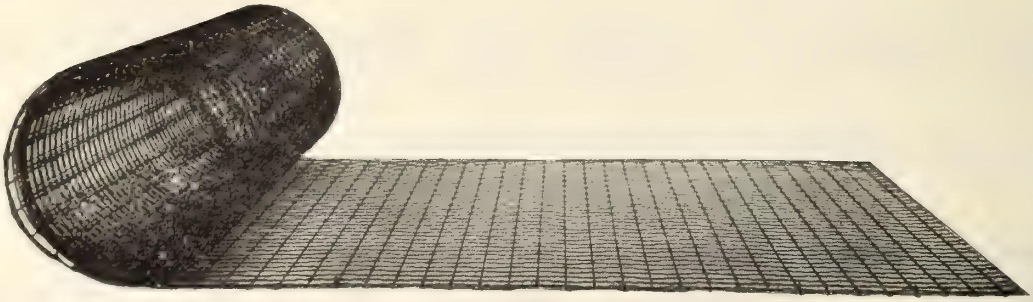

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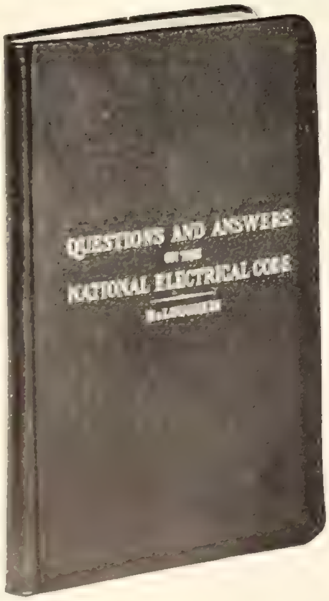

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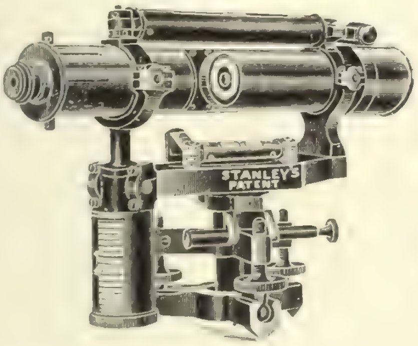

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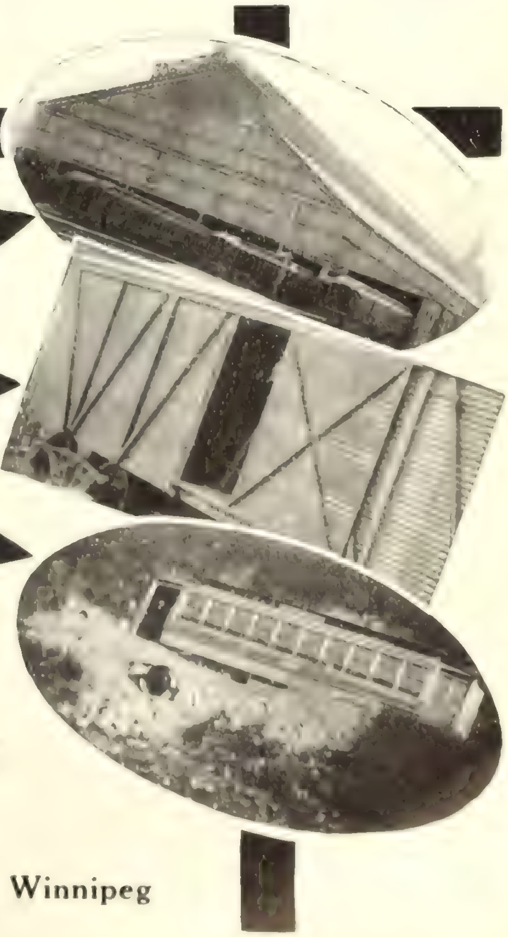

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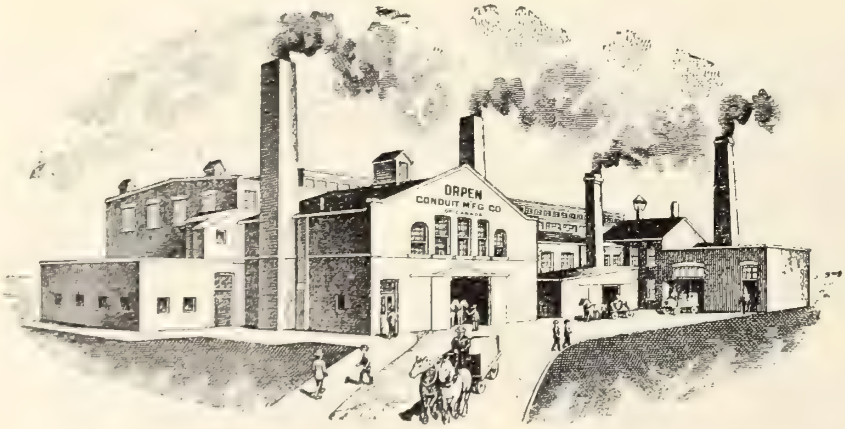

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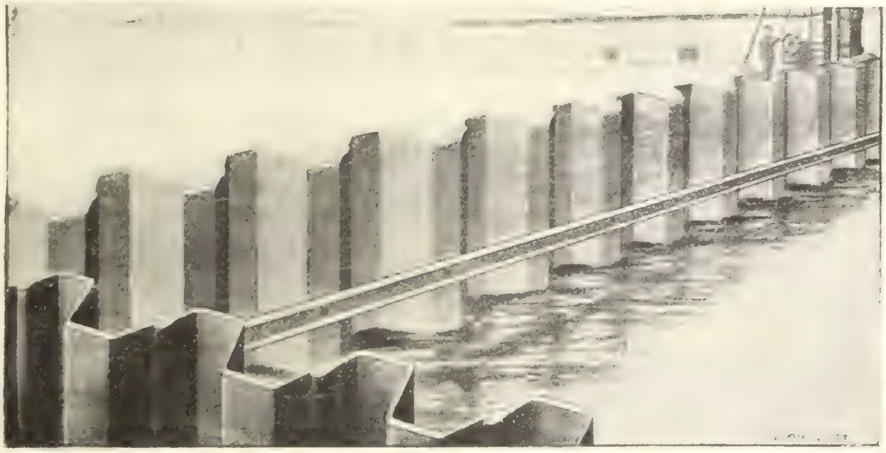

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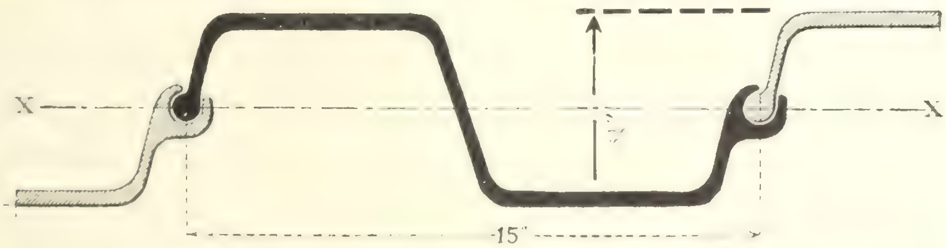

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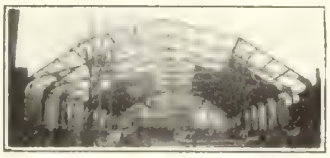

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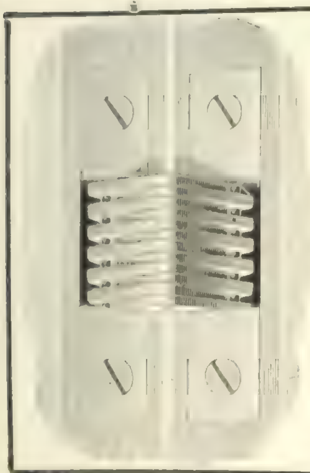

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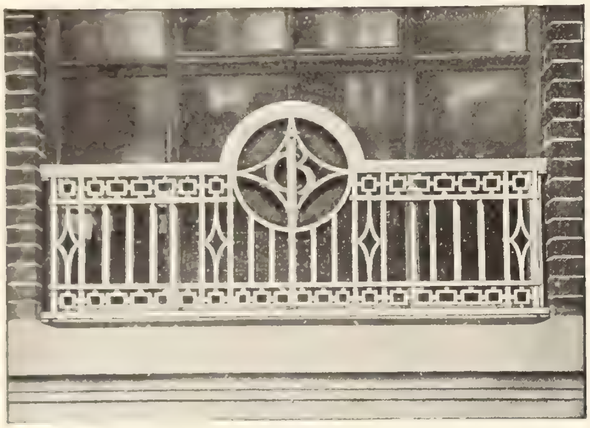

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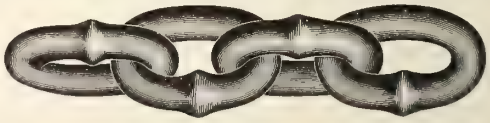

has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.

Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16″ to 3/4″ inclusive.

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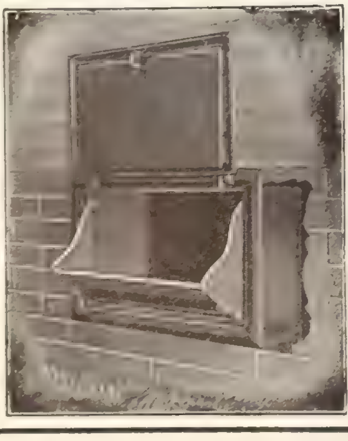

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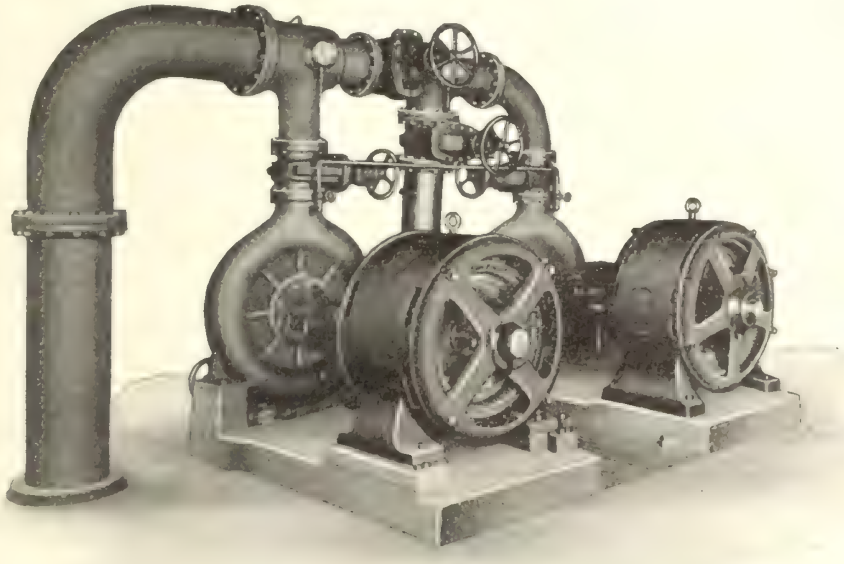

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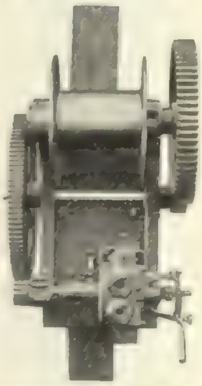

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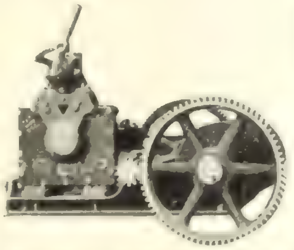

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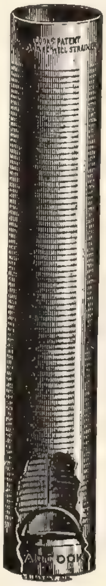

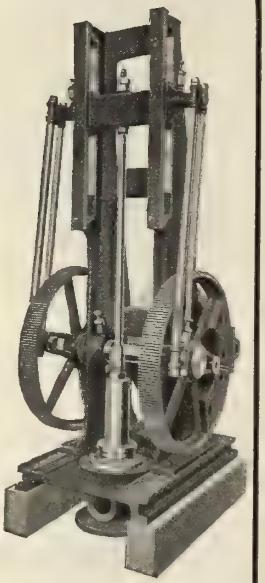

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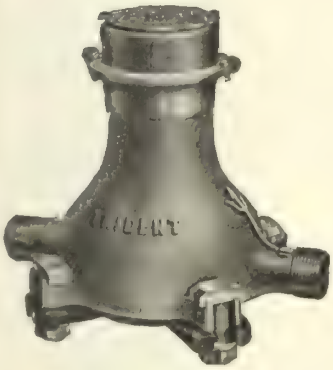

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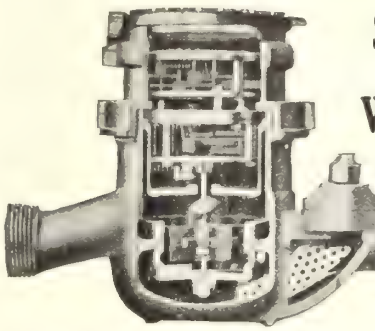

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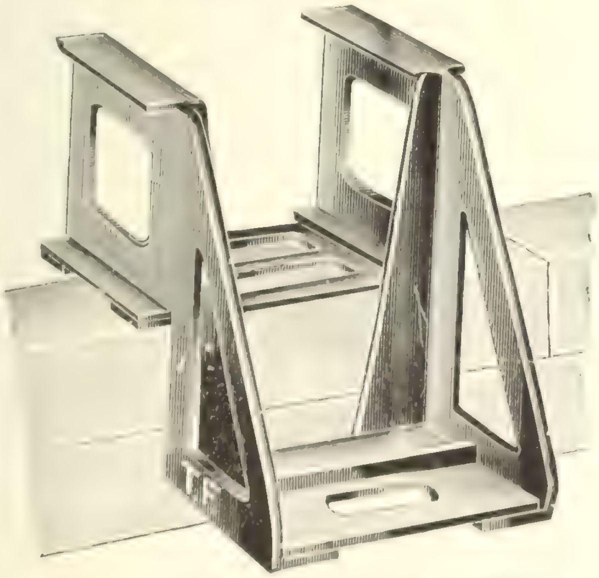

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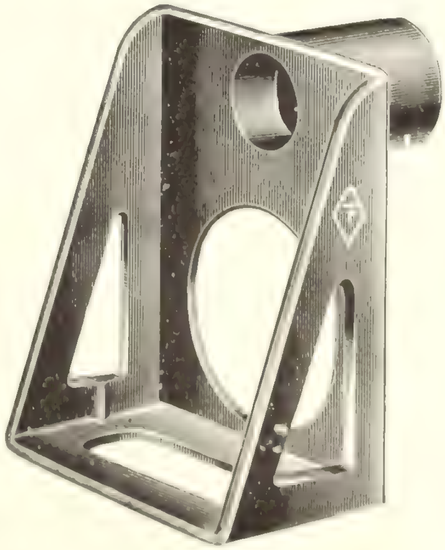

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Brick—No. 1 dry pressed red and buff brick, $18, common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick, $8.60; King Edward siding, $7.50 at the yard; $10.50 delivered on the job. Smooth faced texture [illegible] $15, [illegible] faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18. Brick 2½ x 4 x 8½ in., blocks 3½ x 4 x 8½ in.

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Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

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Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

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Galvanized iron—28 gauge $3.40.

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Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

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MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.90 car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—$1 per ton, car loads, on cars.

Gravel—$1.35, f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. Copper bearing sheets—flat, Apollo keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—British Manilla, 15c basis per pound; second grade, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c, per gal.

WINNIPEG, MAN.

While business in the building and allied industries in Winnipeg could not, at the present time, be considered as unusually active, there is a very fair volume of work in course of construction, and the demand for building materials is fairly strong. This is particularly true of brick, for which, at time of writing, there is quite a brisk call. A good proportion of constructional work in the vicinity of the city, which includes a considerable number of apartment blocks, is being done in brick, and this has tended to a more active movement in clay products. The local plants which cater to this trade report that they are working to capacity. Lumber is moving fairly freely, though less so than was anticipated. Other materials of construction are, to some extent, ousting timber products in Winnipeg district. The increasing use of brick, concrete and other fireproof materials for building is being felt by local lumber concerns. Structural steel, reinforcing bars and similar materials, are only in fair request. There is a moderate call for cement, crushed stone and gravel, and paints and oils are moving freely. On the whole the situation, from the point of view of the supply houses, is satisfactory without being phenomenally active.

Winnipeg Prices

LUMBER (BUILDING MATERIALS)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in carload lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.80 per cu. yd.

Gravel—Per yd., delivered, $1.90.

(Continued on page 106)

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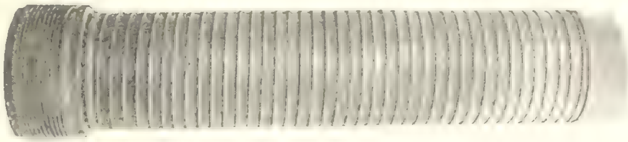

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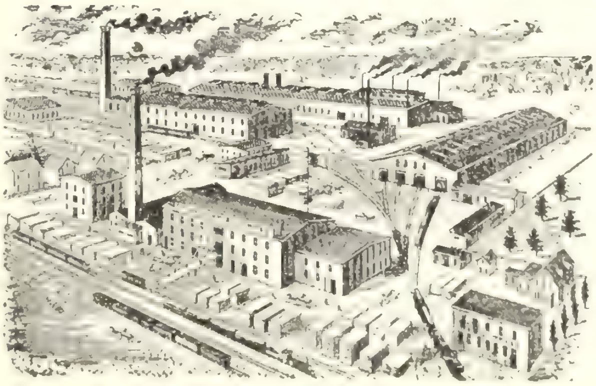

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Hard Wall Plaster (Unsanded), $13 per ton, [illegible] Plaster of Paris, [illegible] per ton.

Paints and Oils—White lead, ground in oil, $8.80 per 100 lbs.; boiled liseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.80 per bbl.; putty in 25-lb. tins, $3.20; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.25; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SUNDRIES AND SPECIALTIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 80c per gal. of 9 lbs.

Raw linseed oil in bbls. 78c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

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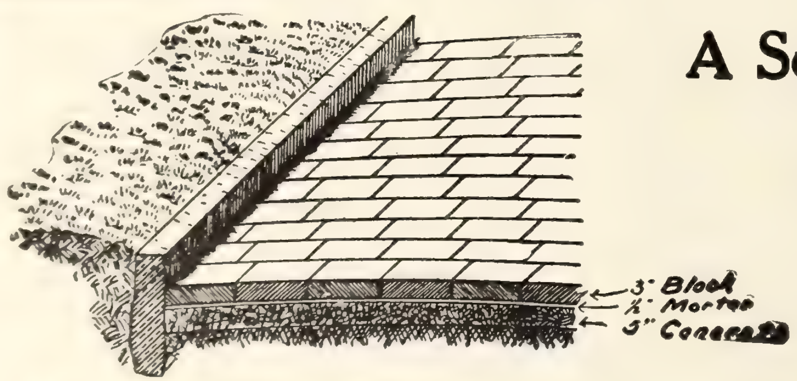

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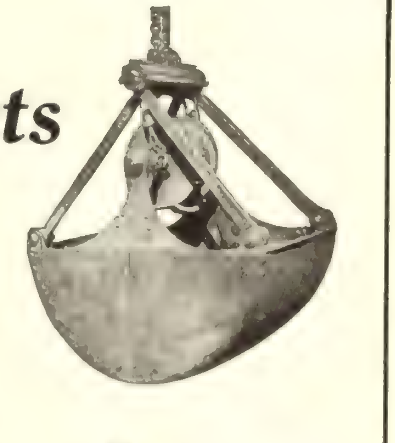

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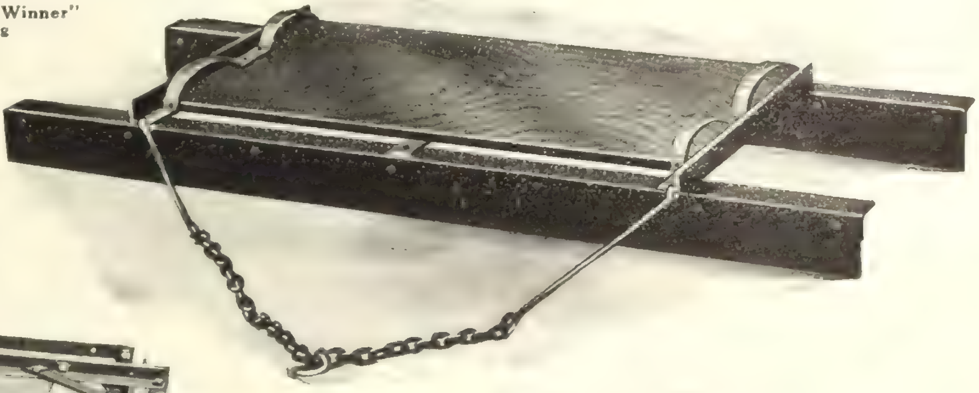

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A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00

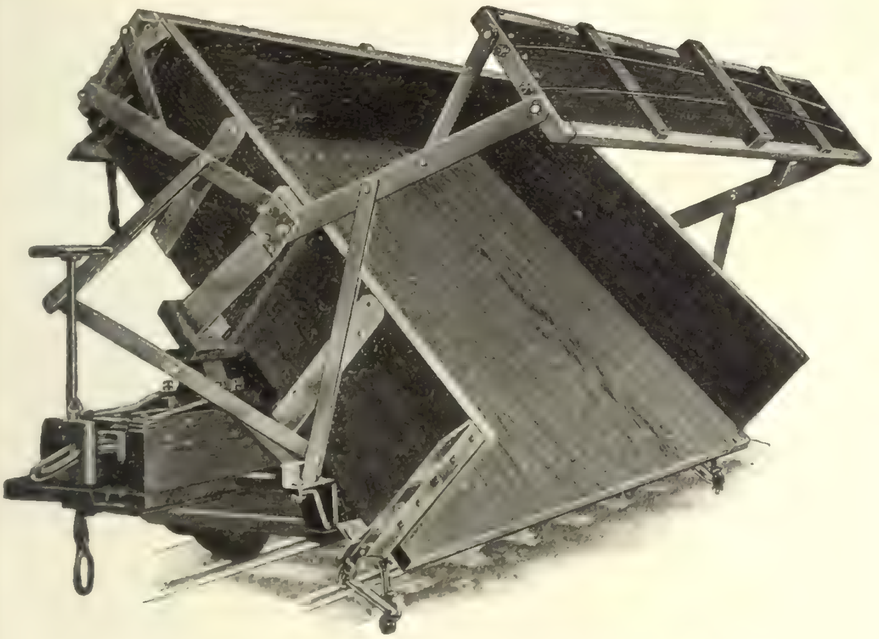
The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons, 102 pages. Illustrated. Price 50c.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited, London. 618 pages, well illustrated. Price $2.00.

A Treatise on the Inspection of Concrete Construction, by Jerome Cochran, C.E. Published by Myron C. Clark Publishing Company. 594 pages. Price $3.00.

Foundations of Bridges and Buildings, by Jacoby and Davis. Published in 1914 by McGraw-Hill Book Company. 602 pages. Illustrated. Price $5.00.

Book Department
Hugh C. MacLean, Limited
220 King Street West - Toronto, Canada



Car showing 4 and 6 yard Double Diamond Steel Frame Car. Our best efforts have been given to these cars for the past year.

We invite the enquiry of all contractors who intend purchasing steel frame equipment now or later. It will pay you to write us at once for full particulars. PRICES RIGHT.

GLENGARRY

You Simply Can't Beat This Car For Dumping!

The wonderfully simple plain dumping irons are at work! Note the door opening and clearance. "GLENGARRY" cars are well up front on every point! In fact we can demonstrate superior points to any other competitor. Strong boxes well supported and end braced. Perfectly trussed diamond frames and drawbars and thoroughly well designed construction are points you want in your new cars. Write us for specifications.

Watch next week's issue!

The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

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MADE IN *Sirocco* **CANADA**

TRADE MARK.

A WORD FOR EFFICIENCY

'Sirocco' Multi Blade Fan wheel built with capacities from 75 C. F. M. to 1,000,000 C. F. M. in single and double inlet types

The word **"Sirocco"** applied to apparatus for Purifying—Cooling—Humidifying—Heating—Ventilating—Drying and Mechanical Draft stands for **a guarantee** of **highest efficiency.**

The **"Sirocco"** is the original fan of the many blade plan. **"Sirocco"** Fans save time over other types, because their design is such as to make use of **every bit** of energy with the least possible waste.

In specifying "Sirocco" Fans you're SURE they'll do exactly as claimed

A "Sirocco" Multi Blade Fan will handle more air consuming less power than the ordinary steel plate fan twice the diameter

Upon request we will gladly send to you a complete set of our Bulletins and Catalogues

Sales Engineers:

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301 McGill Bldg.,
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E. C. POWERS
43 Victoria St.,
Toronto

CANADIAN *Sirocco* COMPANY
LIMITED
WINDSOR, ONTARIO.

Sales Engineers:

W. P. EDDY
401 Tribune Bldg.
Winnipeg

S. S. CLARKE
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"NO SIR: IF YOU WANT MY FACE BRICK YOU MUST TAKE MY INSIDERS AS WELL."

Have you been told this?

What better evidence in favor of

SAND AND LIME BRICK

The brick that can stand alone on its merits. A Good Brick. A True Brick. A Whole Brick.

The brick that sells itself.

Why buy an inferior brick that has to be forced upon you against your will?

Our April shipments were 300,000 weekly. Are they going on your job?

Look for the YSB stock mark.

York Sandstone Brick Co. Limited
TORONTO

OFFICE: 123 Bay St.,
(Stair Bldg.)
Phone Adelaide 2023

WORKS: Cor. Gerrard St. and Victoria Park Ave., East Toronto
Phone Beach 1505

Architects, Owners and Contractors prefer a uniform plaster guaranteed by the maker.

Anchor Hardwall Plaster

Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

Put up in bags ready for immediate use by mixing with water only.

Write or call for prices and booklet.

Alabastine Hardmortar, Ltd.
Works 136 Esplanade East, Toronto
EAST TORONTO Phone Main 6088

Screened Sand and Gravel

Largest Producers, Noted for Prompt Shipment.

York Sand & Gravel, Limited
Tel. Beach 233 East Toronto

CONCENTRATE
Your Builders Supply Orders.

Smyth & Ryan

SERVICE

means prompt delivery and high grade materials at standard prices.

WE CAN SUPPLY YOU WITH EVERYTHING THAT GOES INTO YOUR BUILDING, EXCEPT THE IRON AND LUMBER

Toronto Agents for

OWEN SOUND CRUSHED STONE

Deliveries—G.T.R. and C.P.R.

Special Attention to Sand and Gravel Orders

1327 Bloor West Phone Junc. 828 and 829
53 Merton St. " North 4751
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Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

When completed this will be the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally situated
- Light on four sides
- Passenger and freight elevator
- Vaults
- Low insurance
- One block from four car lines
- Floor area, 6,300 sq. feet, each floor.
- Building ready for occupancy July 1st.

For further particulars ask

R. A. Donald
Union Bank Building - Toronto

> **"We bought a second-hand Sturtevant fan in 1884 that had been in service ten or fifteen years—perhaps longer, and have used it twenty-eight years ourselves with no expense whatever except the oil and work to keep it clean."**
>
> — Name on request

43 Years of Service

When a fan is used forty-three years in a foundry operating at the high speeds necessary without one cent for repairs, this service is conclusive proof of the high-grade design, material and workmanship.

Those contemplating the purchase of a foundry blower must realize what this service would mean to them. This is not an isolated case, we are constantly hearing of such instances.

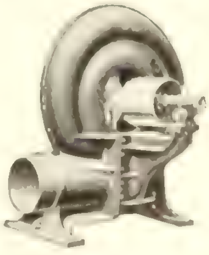
Sturtevant
(REG. CAN. PAT. OFF.)

Steel Pressure Blowers

are built today with the same care, of the same materials as the blower mentioned above. The bearings are lined with the same composition of Sturtevant White Metal.

This blower will give you the same satisfactory service under similar conditions.

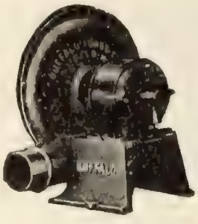
Ask for Bulletin 134-Z



B. F. Sturtevant Company
of Canada, Limited
GALT, ONTARIO

SALES OFFICE FOR EASTERN CANADA
919 New Birks Building, Montreal

No. 228
Size: 32 x 44 inches.



"Buffalo"

No. 681-E Size:-38 x 42 inches "Swing-Over" Hood for auto repair work.

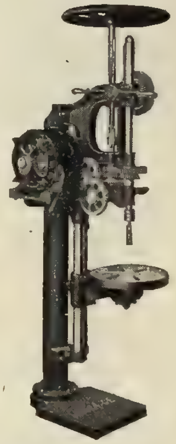
FORGES, BLOWERS, DRILLS

No. 200-P
Hand Blower
Sizes:-12-14-16
inches.

The Standard by which others are judged.

All "Buffalo" Tools combine strength, capacity, small floor space requirements, low power consumption and flexibility to the greatest possible extent. "Buffalo" design and construction are leaders to-day and have been since the inception of the business. Each tool is the best for its particular service. Electrically operated blowers, drills and forges. All sizes for all classes of work. The only efficient variable speed electric motor on the market. Do your work the modern way. Electricity costs less and always responds.

Our catalog No. 179-12 covers the complete line. Every machine is illustrated and described in detail. If you can use a copy write for it.



No. 124-CE Capacity, 1½ inch holes with ½ H. P. motor. Gear guard furnished.

Canadian Buffalo Forge Company, Limited
St. John, Montreal, Toronto, BERLIN, Winnipeg, Vancouver

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

Block Stone, Dimensions, Random, Head Sills, Shoddy, Stone Sawing

Sackville Freestone Co., Limited, Sackville, N. B.

WRITE US FOR QUOTATIONS

Across Canada with the

Imperial Wire & Cable Company, Limited

Fifth of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows

C. P. R. Hotel, Calgary

This building was wired with

"Adanac" Rubber Insulated Wire

Architects and Engineers: E.& W.S. Maxwell, Montreal
Electrical Contractors: Parker Chase Electrical Construction Company, Calgary.

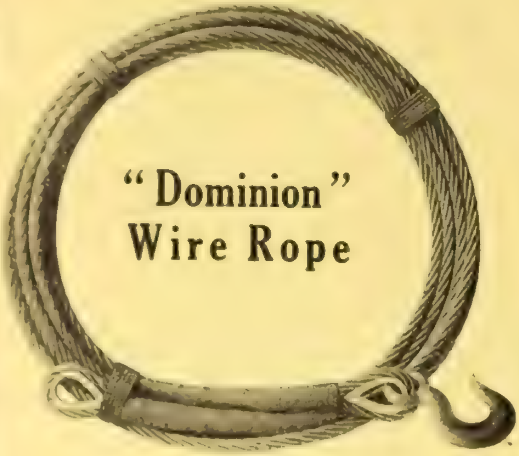
Address enquiries to our nearest office

Northern Electric Company
LIMITED

Montreal
Halifax
Toronto
Winnipeg
Regina
Calgary
Edmonton
Vancouver
Victoria

Successors to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C.P.R Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.



WIRE ROPE

Suitable for any requirement

We carry in stock all sizes and lengths wire rope for

Hoisting, Haulage, Guys, Semaphores, Transmission of Power, Towing, Bridges, Mines, Derricks, Cranes, Cableways, Coal Towers, Etc.

We manufacture special ropes to take care of your particular needs.

WIRE ROPE FITTINGS, BLOCKS, CLIPS, ETC. IN STOCK

The Dominion WIRE ROPE Co. Ltd.
MONTREAL

"Industrial Works"
Locomotive-Coaling and Wrecking

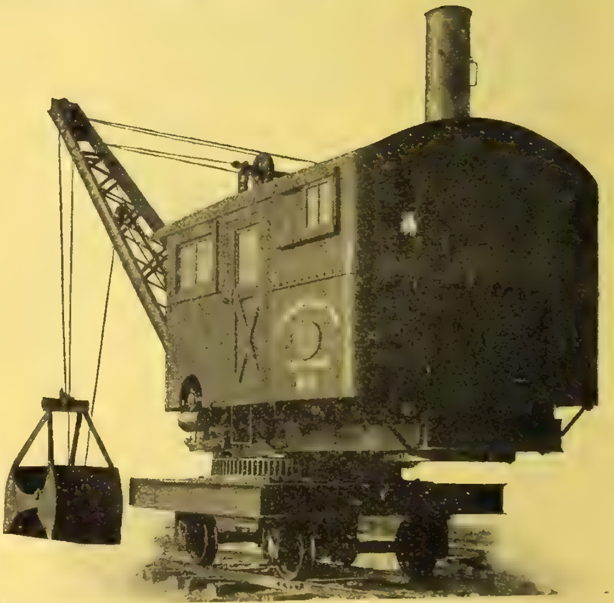
CRANES

In capacities from
5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS

For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., HEAD OFFICE **MONTREAL**

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

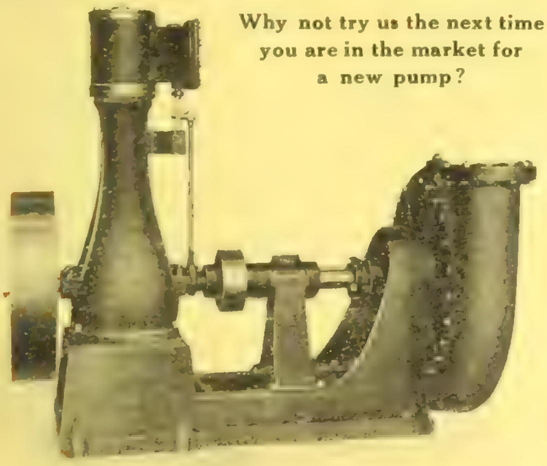
Vol. 28 Toronto, June 10, 1914 No. 23

Contract Record and Engineering Review

ESTABLISHED 1886

Our PUMPS are in use from Coast to Coast

Why not try us the next time you are in the market for a new pump?



The Smart-Turner Machine Co., Limited
Hamilton, Canada

"MADE IN CANADA"

Bent Glass

Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

The Toronto Plate Glass Importing Company, Limited
(HILL & RUTHERFORD, Managing Directors)
Head Office and Works: 91 to 133 Don Roadway
TORONTO

THE "JACKHAMER"

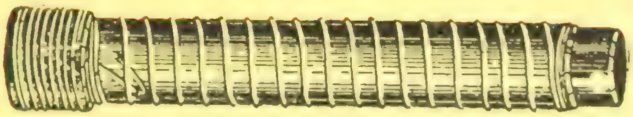
For Shaft Sinking, Quarrying, Open Cut and Trench Work.

Catalogue K68 Describes it.

A "One-Man Drill"

operated by steam or air. Automatic in rotation and lubrication. All-Steel in construction.

Canadian Ingersoll-Rand Co., Limited
MONTREAL, CAN.



Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

"Announcement"

In addition to a full line of other types of crushing machinery and equipment we are now building

Gyratory Crushers

of most modern design and equipped with an improved

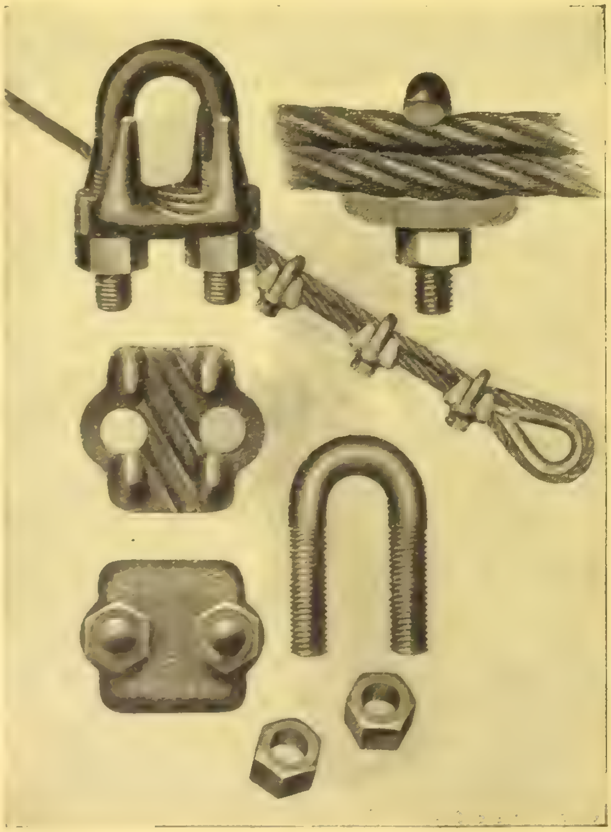
Water Cooled Eccentric Bearing

Made in all sizes for all capacities and
for crushing any kind of material.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catherines Toronto Montreal Cobalt South Porcupine
Vancouver and Nelson



"CROSBY" CLIPS ALL WAYS, ALWAYS

The one absolutely secure and dependable wire rope fastening is the drop forged steel, galvanized

"CROSBY" CLIP

Built for greatest gripping power—immune to rust.

IT HOLDS

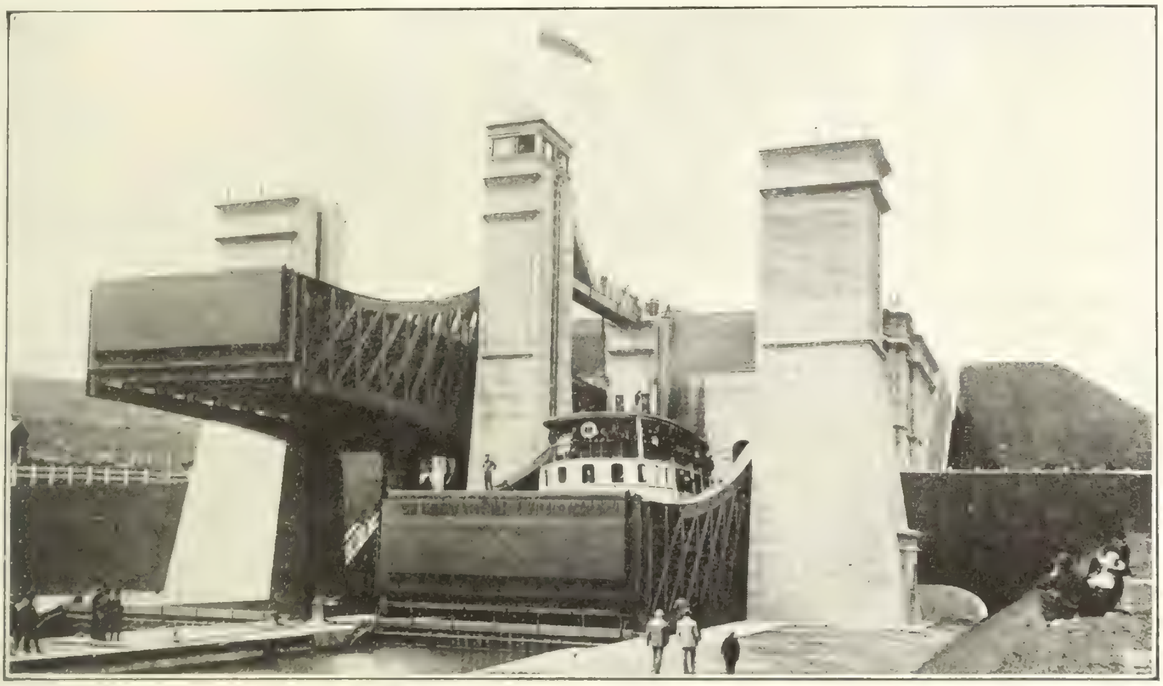
In the interests of safety use no other on guy or hoisting lines.

MADE BY

American Hoist & Derrick Co.

ST. PAUL, MINN.

SOLD BY General Supply Co., of Canada, Ltd. Montreal, Ottawa, Toronto, Canada. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.



Hydraulic Lift Lock, Peterborough, Ont. Monolithic Concrete Construction containing 26,000 cubic yards. Height of Lift 65 feet. Weight of water in each tank, 1,300 tons.

Concrete's Stability and Strength

In the building of any structure to withstand the strain of a live load such as is imposed on the Peterboro Lift Lock, the factors of stability, strength and economy in any material must necessarily be considered first in importance.

Any structure with sufficient strength to sustain so great a live load must be built in a unit to give the required stability, and there is no doubt that concrete is the best material that could have been adopted for this purpose. Its use

Means Economy

by reason of the greater portion of the material and labor being obtainable in the district in which a concrete structure is built. This facilitates construction, means convenience to the contractor, and returns most of the cost to the people of the district.

Let us send you fullest information about concrete structures for every purpose, without cost or obligation.

Information Department

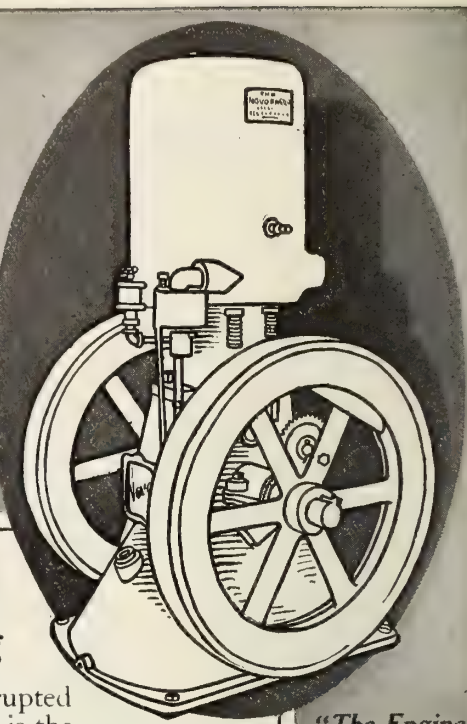
Canada Cement Company
Limited
882 Herald Building, Montreal

NOVO

REG. U.S. PAT. OFF.

ENGINES AND OUTFITS

NO TANK
NO FAN
NO FREEZING
TROUBLE



"The Engine for Every Purpose"

For the Man Who Cannot Afford to Let the Wheels Stop Turning

For the man who *must* have uninterrupted power at reasonable cost—the Novo Engine is the best answer to his power problem. The Novo Engine has proved that it will stand up under the hard, gruelling test of contract work. Furthermore, Novo power has proved itself cheaper than steam or electricity in fuel consumption per horse power developed as well as in other costs of operation, in maintenance and in capital invested.

The light weight of the Novo and the small space it occupies, its simplicity and easy portability are advantages no power user should overlook. Its frost-proof cooling system, automatic fuel control, compactness and power, fit it for work of every sort—make it truly "The Engine for Every Purpose."

Its adaptability for portable or stationary uses and outdoor service is practically unlimited.

The Novo Engine is built four-cycle to make its fuel consumption low, to last longer, to be adaptable to speed and load variations met with in rough service.

The Novo is made vertical to be lighter, more readily portable and to occupy less floor space, and to enable it to be more easily lubricated.

The Novo hopper-cooling system is designed in its peculiar form to make the engine proof against damage from freezing, to make unnecessary the draining off of the cooling water in winter, to make the engine run with greater efficiency and to prevent overheating.

Let us send you "Reliable Power," the Novo Book

one of the most valuable engine books ever published for the use of the man who wants to know how to get cheaper and better power. Sent free if requested on your business letterhead.

Novo Outfits

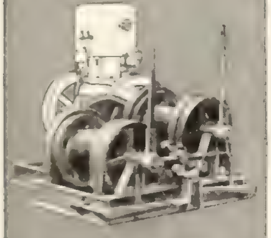
Novo Hoists—Made in three general types—non-reversible, reversible and double drum—and in ten sizes from 600 to 4,500 lbs. lifting capacity. They are used in building construction, ice handling, logging, car hauling, back filling of sewers, freight handling and similar work.

The Novo Double Drum Hoist is the newest addition to the Novo line, equipped with 10, 12 and 15 H P engines. See Fig. 14120.

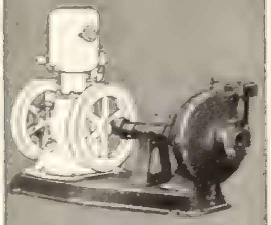
Novo Centrifugal Pumps—Made in three types—chain drive, direct-connected and belt-driven. For draining excavations and for irrigation. Mounted on all steel trucks, channel-steel or solid iron bases.

Novo Suction and Force Pumps are made in numerous styles and sizes, to fit all requirements, with capacities of from 300 to 10,000 gallons per hour. They are used for farm and home water-supply systems, for factories, filling railway tanks and city water service. Mounted on channel-steel or cast-iron bases, according to character of pump.

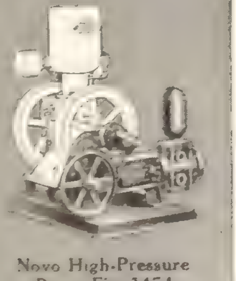
MUSSENS LIMITED Montreal, Toronto, Quebec, Winnipeg, Calgary, Vancouver, St, Johns, N.B., Halifax, Cobalt



Novo Double Drum Hoist Fig. 14120

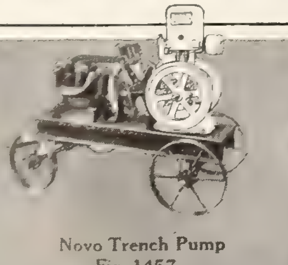


"Little Giant" Centrifugal Pump Fig. 1478

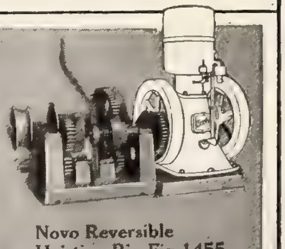


Novo High-Pressure Pump Fig. 1454

Novo Suction and Force Pump Fig. 1401



Novo Trench Pump Fig. 1457



Novo Reversible Hoisting Rig Fig. 1455

Do you make Machinery

that is or may be run by gasoline power?

Do you sell a completely equipped cement mixer, saw rig, pumping outfit, etc.?

Then consider the immense sales advantage your product will have if run by a Novo Engine; if equipped with an engine that is, today, operating over 60% of the best cement mixers in the world.

First—The advantage of an engine that has proved its absolute reliability; that removes "engine trouble" as a factor in selling your outfit.

Second—Figure out the added prestige that a combination of two good machines must produce.

Third—Realize the profit to be gained from the advertising that has made the Novo Engine so well known. It gives you a sales argument that parallels that of the automobile manufacturer in featuring a standardized axle, carburetor or self-starter. Let us get together for our mutual benefit.

A Guarantee Against Defects

for the LIFE of the BLOCK goes with every

READING Multiple Gear CHAIN BLOCK

It is the only block whose entire working parts are protected by a dust-proof casing and operate in a bath of oil.

It has cut steel gears, accurate construction, hand-made tested chain.

It will stand harder usage and cost less for maintenance than any other block.

It takes three men with a Differential Block or two men with a Screw Block to do one man's work with a Reading Multiple Gear Chain Block.

It lifts quickly. It works easily.

It enables your men to do more work.

It will save you expensive repairs.

Carried in stock.

Try a Reading in comparison with any other block

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.

QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

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Hull Iron & Steel Foundries

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Can. Ingersoll-Rand Co., Ltd.
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Architects' Instruments
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Chain Blocks
Can. Yale & Towne Limited.
Morris Crane & Hoist Co., Herbert.

Coal Chutes
Galt Stove & Furnace Co.
Manitoba Bridge & Iron Works.

Coal Handling Apparatus
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Weller Mfg. Co.

Concrete Mixers and Appliances
Austin Drainage Excavator Company, F. C.
Badger Concrete Mixer Co.
Canadian Allis-Chalmers, Ltd.
Canadian Concrete Appliance Co.
Hopkins & Co., F. H.
Jaeger Machine Company.
Koehring Machine Co.
Knickerbocker Co.
Lecky & Collis
London Concrete Machinery Co.
Marsh Capron Company.
Mills Bros.
Municipal Engineering & Contracting Co.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.
Wettlaufer Bros.

Contractors
Anglins Limited
Eastern Pipe Construction Co.
Foundation Company, Limited
Reggin & Spence
Wells & Gray.

Contractors' Plant & Supplies
American Hoist & Derrick Co.
Austin Drainage Excavator Company, F. C.
Badger Concrete Mixer Co.
Barber Asphalt Paving Co.
Bateman Wilkinson Co.
Beatty & Sons, M.
Browning Company
Canadian Allis-Chalmers, Ltd.
Can. Billings & Spencer
Canadian Fairbanks-Morse Co.
Canadian Locomotive Company
Canadian Brakeshoe Co., Ltd.
Canadian Concrete Appliance Co.
Central Locomotive & Car Works
Dake Engine Co.
Dominion Lime Company.
Dore & Fils
Dull Co., Raymond W.
Erie Iron Works
General Car & Mach. Works.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Hepburn & Co., J. T.
Honig & Mock.
Hopkins & Co., F. H.
Jaeger Machine Company.
Jenckes Machine Sompany
Koehring Machine Co.
Lecky & Collis
Marsh & Henthorn
McKinnon Chain Co.
Mills Bros.
Morris Machine Works.
Municipal Engineering & Contracting Co.
Montreal Locomotive Works
Mussens Limited
Parsons Company, G. W.
Radigan Company, John
Royce Limited
Sauerman Bros.
Schell Foundry & Machine Co.
Stinson-Reeb Builders' Supply Co.
Sudbury Construction & Machinery Co.
Stratford Mfg. Company
Tiffin Wagon Works.
Wettlaufer Bros.

Controlling Altitude Valves
Golden Anderson Valve Co.

Conduits
Can. H. W. Johns-Manville Co.
Conduits Co., Limited
Orpen Conduit Mfg. Co. of Can.
Ric-Wil Underground Pipe Covering Co.

Contractors' Barrows
Erie Iron Works
Meaford Wheelbarrow Co.

Contractors' Flare Lights
Sudbury Construction & Machinery Co.

Conveying Machinery
Goodwin, Barsby & Co.
Sturtevant Co. of Can. Ltd. B. F.
Sutcliffe, Speakman & Co.
Weller Mfg. Company

Core Drills
Can. Ingersoll-Rand Co., Ltd.

Corrugated Iron
Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Ormsby, A. B., Limited
Pedlar People Limited.

Cranes, Travelling and Locomotive
American Hoist & Derrick Co.
W. D. Beath & Son
Browning Company.
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.
Northern Crane Works.
Rock & Power Machinery, Ltd.
Roelofson Elevator Works.
Royce Limited

Creosote Stains
Cabot, Inc., Samuel

Crushed Stone and Granite
Hagersville Contracting Co.
Ontario Lime Co., Ltd.
Rogers Supply Company
Smyth & Ryan

Crushers (Stone and Rock)
Canadian Allis-Chalmers, Ltd.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Hopkins & Co., F. H.
Jenckes Machine Co.
Lecky & Collis
London Concrete Machinery Co.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.
Wettlaufer Bros.

Culverts
Pedlar People.

Cupolas (Foundry)
Northern Crane works

Cylinders for Liquified Gases
Mannesmann Tube Co.

Derricks and Derrick Fittings.
American Hoist & Derrick Co.
Beath & Son, W. D.
Hepburn, John T.
Sasgen Derrick Company

Dredges
Beatty & Sons, M.
Browning Company.
Morris Machine Works.

Drills
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis
Star Expansion Bolt Co.

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Provincial Government of Ontario Adopts the CEMENT-GUN at Whitby Harbor

Over 120,000 square yards of interior plastering and exterior cement mortar work—(Gunite)—to be applied by Cement-Gun on the buildings shown in illustration.

WE shall be glad to mail you illustrated Bulletins describing in detail the Cement-Gun and some of the important engineering work on which it has been used.

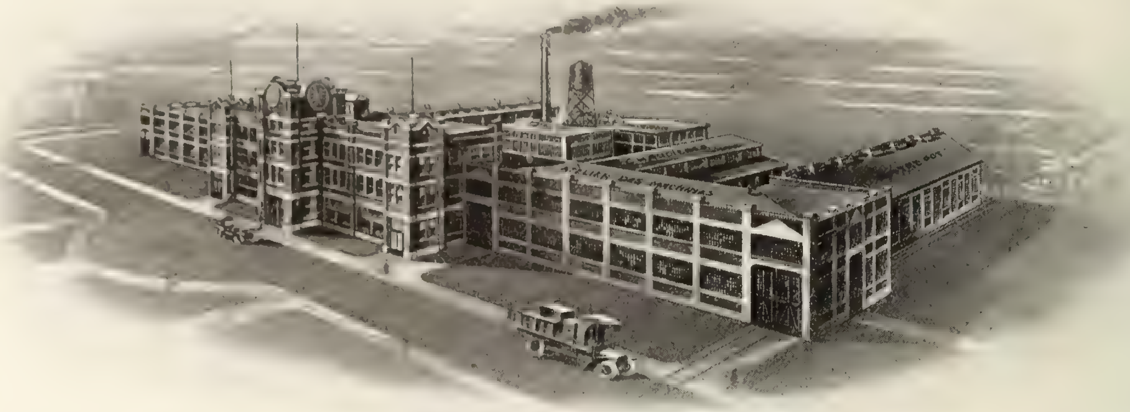
Cement-Gun Company, Inc.

Exclusive Sales Agents for the Dominion of Canada

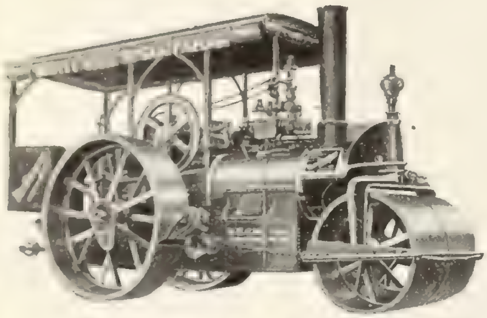
30 Church St., N. Y. City

General Car and Machinery Works, Limited

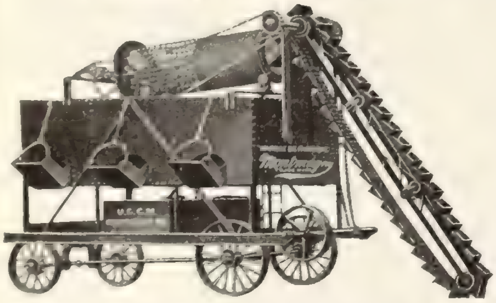
Quebec **MONTMAGNY, P.Q., Can.** **Montreal**



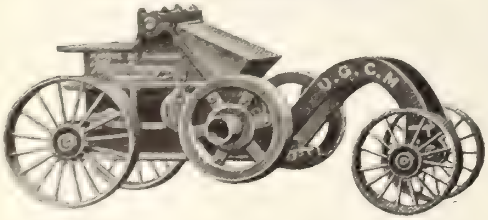
Head Office and Works



"Montmagny" Steam Road Roller.



"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny"

Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

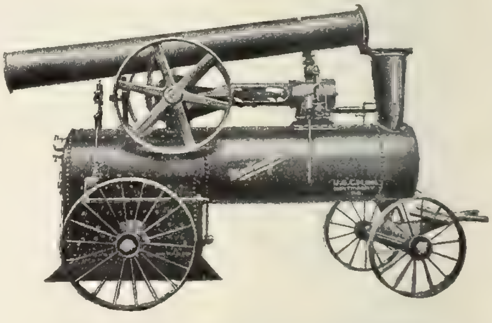
A great feature
"Power Steering"

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

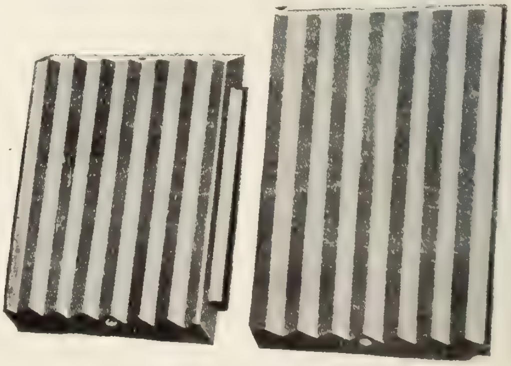
The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

For crushing field stone, granite, etc., "Montmagny" jaws are made of manganese steel. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.

"Montmagny" Road Sprinkler.
The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.

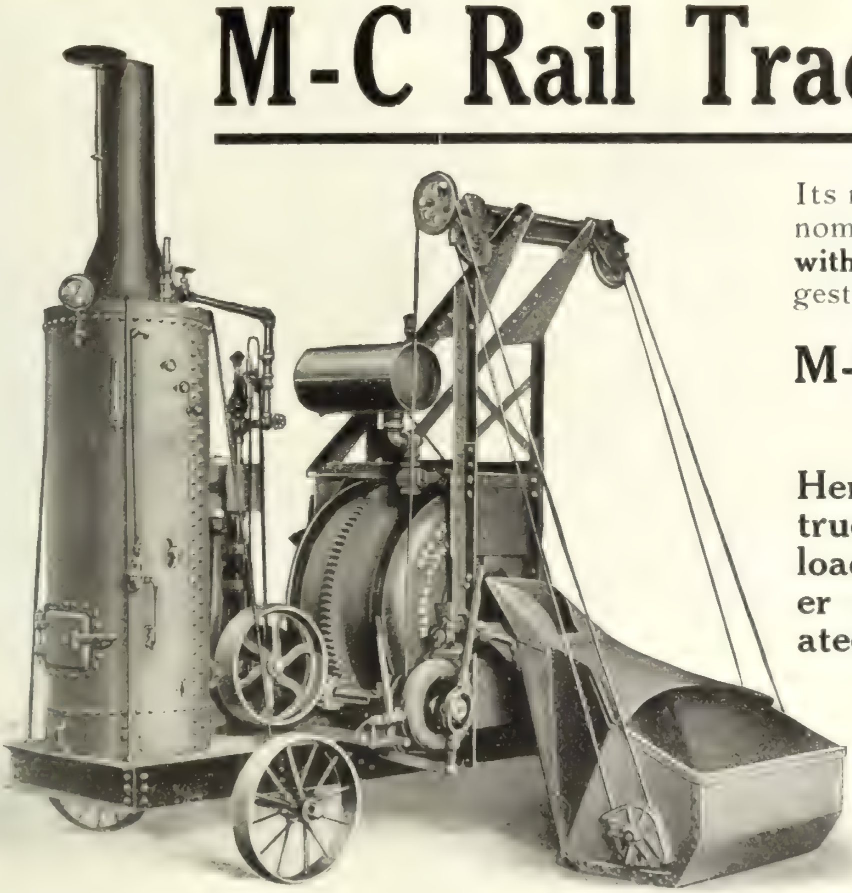


"Montmagny" Portable Steam Engine.
A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.



"Montmagny" Manganese Steel Jaw Plates

M-C Rail Track Mixer

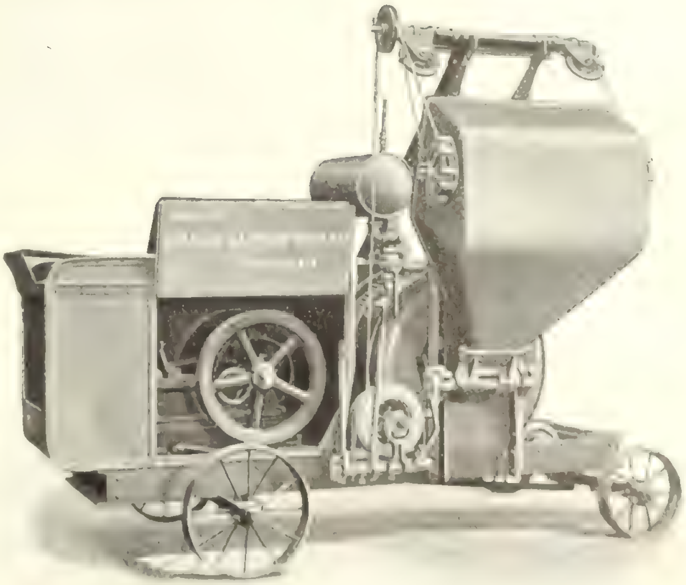


Its reputation for lasting, economical service—**"most mixing with least fixing"**—is the biggest thing to remember about the

M-C RAIL-TRACK MIXER

Here it is—mounted on trucks, with elevating side loader and automatic water measuring tank; operated by steam engine.

The all-steel rail tracks around the drum, the segmental drum gear, the roller-bearing wheels of chilled semi-steel, the semi-steel drum of great strength and toughness, the heavy steel channel frame, the M-C friction clutch are some of the construction features of this machine which will end your mixer troubles.



The two illustrations show you M-C Rail-Track Mixers operated by steam and gasoline power.

This mixer is built in five sizes, with capacities of ¼, ⅓, ½, ¾ and 1 cu. yard of concrete per batch.

Capacity 6 to 27 cu. ft. of mixed concrete, or 9 to 40 cu. ft. of loose material per batch.

[illegible]

CANADIAN FAIRBANKS-MORSE CO., Limited

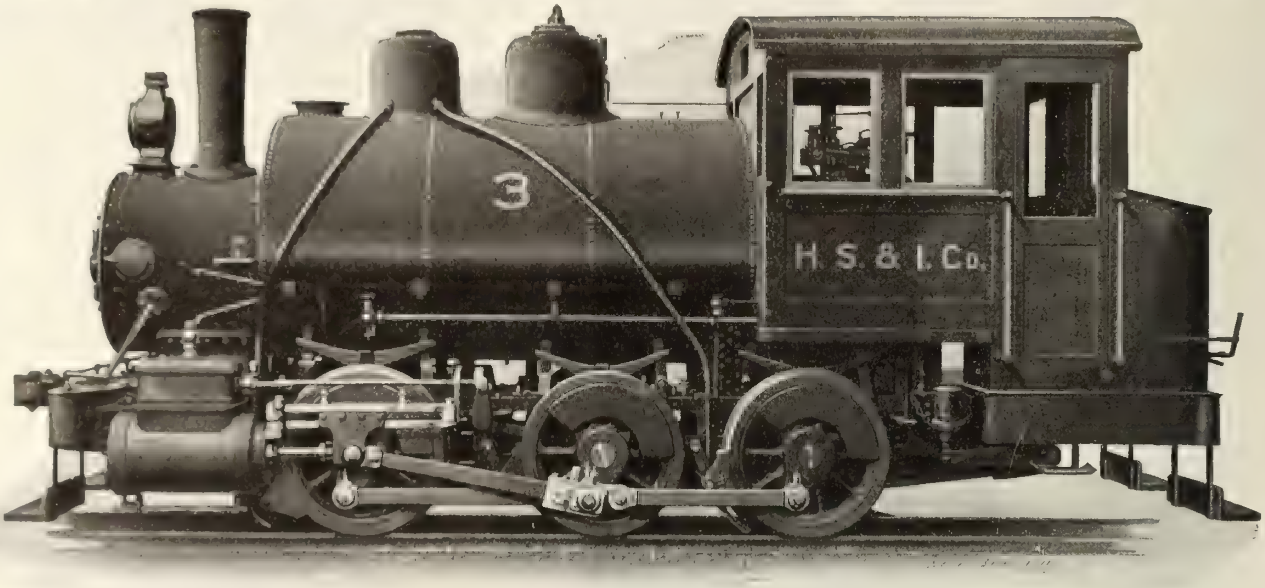
Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company

465 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty year experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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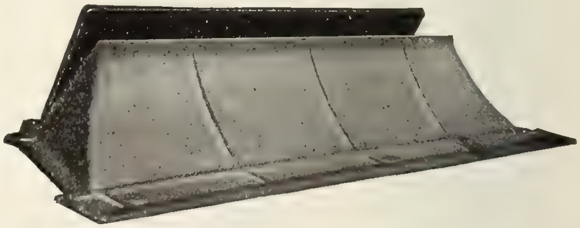
10 % Off

"COVERT IMPROVED" DAMPER



Owing to the increased sales of the "Covert Improved" Fireplace Throat and Damper we are pleased to announce to our friends and customers **a General Reduction of 10 Per Cent.** in the price of this specialty.

THE "COVERT IMPROVED" DAMPER

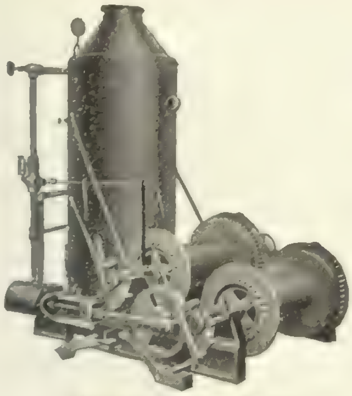
Used by the Canadian Bank of Commerce in various branches throughout Canada; the Ontario Provincial Government in Hospital installations; and in many other prominent buildings and residences.

Write for your copy of "Hints on Fireplace Construction"

Manufactured and Sold By

Black Building Supply Co., Ltd.

202 Mail Bldg. **TORONTO** **Telephone Main 331**



Standard Hoisting Engine

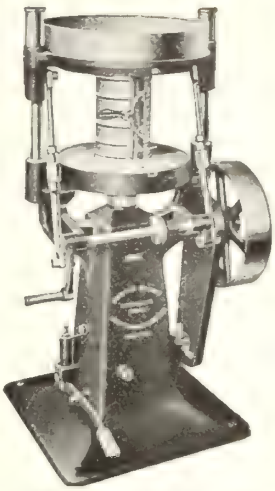
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur, Ont.—Northern Agency Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

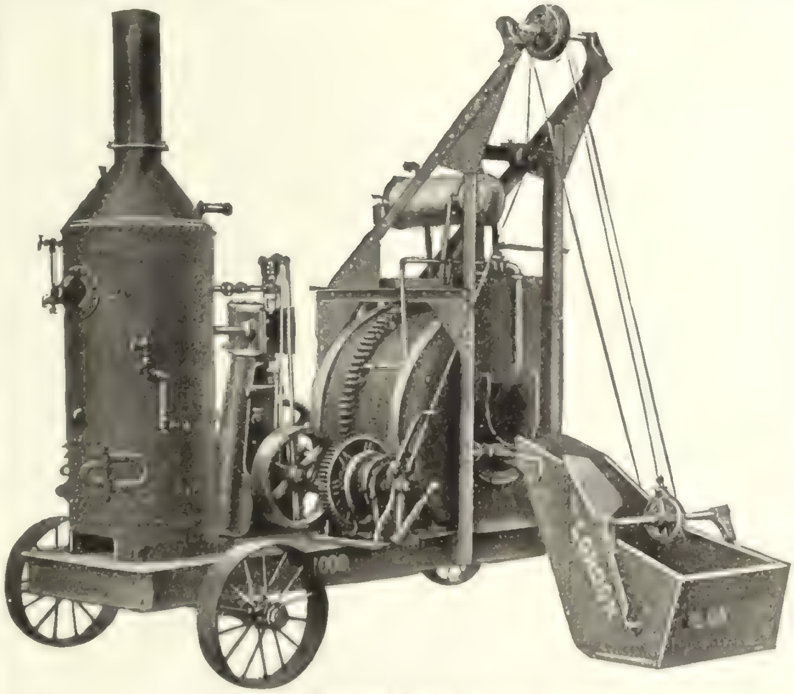
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

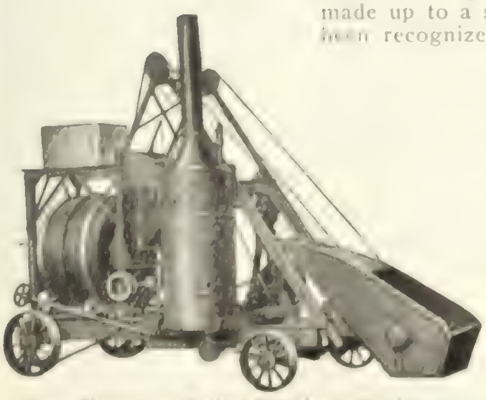
—

Pumping Outfits

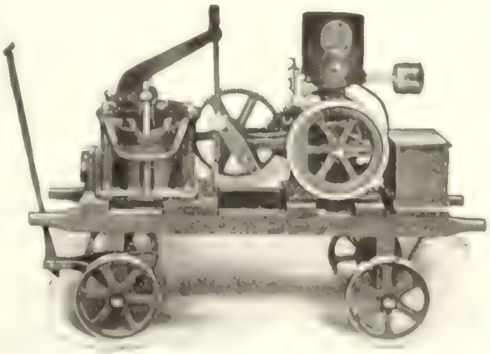
—

Hoists and Derricks

Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada. We also manufacture a full line of hoisting engines and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader



Diaphragm Pump with Engine

Correspondence Solicited.

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Drop Forgings
  Canadian Billings & Spencer, Ltd

Dump Cars, Wheels, etc.
  [illegible] Limited
  Manitoba Bridge & Iron Works.
  [illegible] Foundry & Machine Co.
  Western Wheeled Scraper Co.
  Weber Mfg. Co
  Sheldons Limited.

Dump Carts and Wagons
  Deere Plow Co., John.
  Troy Wagon Works

Drying Apparatus
  Sturtevant Co. of Can. Ltd. B. F.

Electric Fans
  Sturtevant Co. of Can. Ltd. B. F.

Electric Air Rock Drills
  Canadian Ingersoll Rand Co.

Electric Impulse Clocks
  [illegible] & Company

Electric Steel Castings
  Electric Steel & Metals Co.

Elevators
  Roelofson Elevator Works.

Enamelled Brick
  American Enamelled Brick & Tile Company
  National Builders' Supply & Enamel Concrete Brick Co.

Engines
  Boving Company of Canada
  Canadian Buffalo Forge Co.
  Canadian Sirocco Co.
  Inglis Co., John
  Jenckes Machine Co.
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks
  Mussens Limited
  Rock & Power Machinery
  Waterous Engine Works Co.
  Wettlaufer Bros.

Engineers (Civil and Mechanical)
  Aird Murray & Lowes
  Bowman & Connor
  Campbell, R.
  Chipman & Power
  Dominion Engineering & Inspection Company.
  Farmer, John T.
  Galt Engineering Co., John
  Lea & Ferguson
  Mitchell, C. H.
  Thorold Co., F. W.
  Tyrrell, H. G.

Excavators
  Austin Drainage Excavator Company, F. C.
  Brown Hoisting Machinery Co.
  Municipal Engineering & Contracting Company.
  Parsons Company, G. W.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Expansion Bolts
  Star Expansion Bolt Co.

Expanded Metal
  Mannesmann Tube Co.
  Pedlar People Limited.

Fans
  Canadian Sirocco Co.
  Sheldons Limited.
  Sturtevant Co. of Can. Ltd. B. F.

Fuel Economizers
  Sturtevant Co. of Can. Ltd. B. F.

Electrical Machinery and Supplies
  Ferranti Electrical Co.
  Sturtevant Co. of Can. Ltd. B. F.

Field Instruments
  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Fire Brick
  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works.
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry.
  Mussens Limited
  Pedlar People Limited.
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Fixtures (Gas)
  Consumers Gas Co.

Floor and Wall Tile
  Frontenac Floor & Wall Tile Co.

Folding Doors
  Springer, O. T.

Forges
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

Gas Engines
  Armstrong Mfg. Co.
  British Mfrs. Assn. of Canada.

Gasoline Engines
  Armstrong Mfg. Co.
  Mills Bros.
  Original Gas Engine Co.

Glass
  Consolidated Glass Co.
  Excelsior Plate Glass Co.
  Hobbs Mfg. Co.
  Luxfer Prism Co.
  Pilkington Bros.
  Toronto Plate Glass Imp't'g Co.

Hammer Drills
  Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Escher Wyss & Co.
  Mannesmann Tube Company.
  Pittsburgh Valve, Foundry & Construction Company

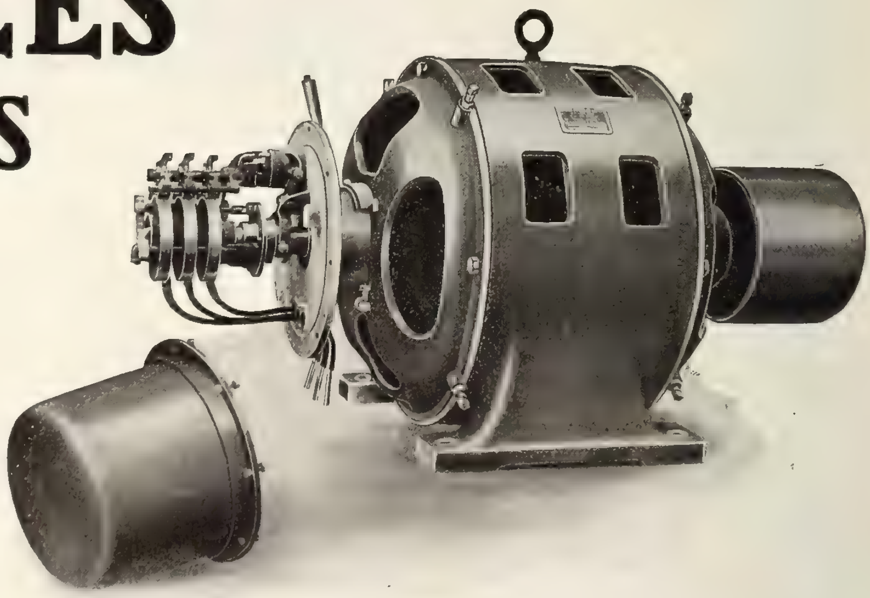
Hoisting Apparatus
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Fairbanks-Morse Co.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
  Marsh & Henthorn
  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Rock & Power Machinery
  Royce Limited
  Sturtevant Co. of Can. Ltd., B. F.

(Continued on Page 14)

PEEBLES MOTORS
(A.C. or D.C.)

A type suited
to every case.

Let us figure
on your next
proposition.

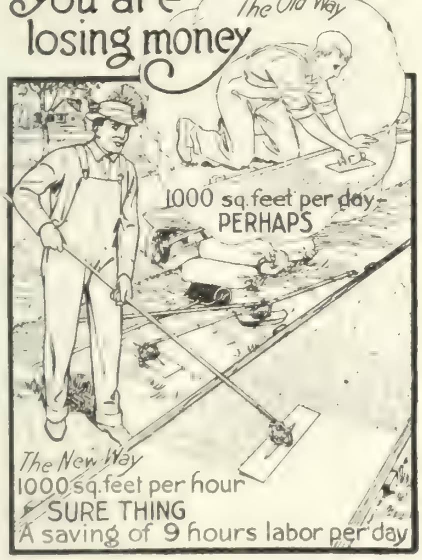


The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money



Abram Cement Tool Co.,
Windsor, Ontario

WESTERN
Spreader Cars

The Western Spreader Car has recently been improved and strengthened at various points. The flat car is specially designed to withstand the strain which a machine of this type must undergo in operation. The Western Spreader is equipped with a pair of blades which can be used simultaneously or separately. These blades will level the earth to a distance of 15 feet from the rail, and can be swung back rapidly against the car when passing trains.

Our illustrated catalogue contains full details of the best line of earth and stone handling machinery in America.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built of a
Tough
Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Heating Apparatus
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co
- Sheldons Limited

Hoists
- Roelofson Elevator Works
- Northern Crane Works.
- Stratford Mfg. Company

Hoisting Engines
- Canadian Allis Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.

Hydrants
- Canada Iron Corporation
- Gartshore Thomson Pipe Co.
- Kerr Engine Company

Industrial Cars
- Central Locomotive & Car Works

Insulating Compounds
- Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
- Batts Limited
- Canada Office & School Fur. Co.
- Rhodes Curry & Co.

Jib Cranes (all kinds)
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Kilns
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.
- Canadian Sirocco Co.
- Berg Machinery Mfg. Co.

Lime
- Dominion Lime Company.
- Jamieson Lime Co.
- Ontario Lime Co., Ltd.
- Standard White Lime Co.

Lighting and Pumping Installations
- Lister & Co., Ltd., R. A.

Locks
- Can. Yale & Towne Ltd.

Locomotives
- Boving Company of Canada
- Central Locomotive & Car Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Locomotive Company
- Montreal Locomotive Works
- F. H. Hopkins Co.
- Mussens Limited

Metal (Anti-Corrosive)
- Stark Rolling Mill Co.

Metal Lath
- Greening Wire Co., B.
- Metallic Roofing Co.
- Noble, C. W.
- Pedlar People Limited.
- Steel & Radiation Ltd

Meters, Electrical
- Siemens Co. of Canada, Ltd.
- Ferranti Electrical Mfg. Co.
- Canadian Allis-Chalmers, Ltd.

Mechanical Draft Apparatus
- Sturtevant Co. of Can. Ltd. B. F.

Meters, Water
- Hopkins & Co., F. H.
- McDougall Caledonian Iron Wks
- Neptune Meter Co.
- Siemens Co. of Canada, Ltd.

Overhead Runways
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert.

Paints and Varnishes
- Dominion Paint Works
- Hopkins & Co., F. H.

Paving and Paving Materials
- Asphalt & Supply Co.
- Aztec Oil Asphalt Co
- Bessemer Limestone Co.
- Baker Co., R. D.
- Barber Asphalt Paving Co.
- Dominion Creosoting Company
- Dunn Wire-Cut-Lug Brick Co.
- Ontario Asphalt Block Co.
- Paterson Mfg. Co., B.

Pipe (Concrete, Iron and Wood)
- American Spiral Pipe Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Pipe Co.
- Dominion Concrete Co.
- Gartshore-Thomson Pipe Co.
- Gerald Lomer, Ltd.
- Mannesmann Tube Company.
- National Concrete Mfg. Co.
- National Iron Works
- National Pipe & Foundry Co.
- Pacific Coast Pipe Co.
- Piggott & Co., Thos.
- Steffens & Nolle
- United States Cast Iron Pipe Co
- Vancouver Wood Pipe & Tank Company.
- Walsh Plate & Structural Works.

Partition Hangers
- Springer, O. T.

Paints (Bridge and Structural Iron and Pipe Coating)
- Dominion Paint Works

Perforated Metals
- Canada Wire & Iron Goods Co.
- Greening Wire Co., B.

Pipe Machinery
- Sutcliffe, Speakman & Co.

Pile Driving Machinery
- American Hoist & Derrick Co.
- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Ingersoll-Rand Co.
- Lecky & Collis

Pipe Fittings and Flanges
- Pittsburgh Valve, Foundry & Construction Company

Plumbing Supplies
- Mueller Mfg. Co., H.

Planing Mill Exhausters
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Canadian Sirocco Co.

Plaster
- Alabastine Hardmortar Co.
- Albert Mfg. Company
- Britnell & Company
- Ontario Lime Co., Ltd.

Plate Glass
- Excelsior Plate Glass Co.
- Pilkington Bros.

(Continued on page 18)

80,000,000 Candle Power

Cause no fire or serious accident

There are over 80,000 Milburn lights in use. All meet the most exacting demands of contractors, railways, life saving stations and others requiring a powerful outdoor illumination.

It is now recognized as standard and is used on construction work in mines and quarries, on steam shovels and dredges, in camps and many other places.

There is no more efficient or simpler light on the market.

Write now for complete catalogue

The Canadian Fairbanks-Morse Co., Limited

Montreal Toronto Winnipeg Calgary
Quebec Ottawa Regina Edmonton
St. John Hamilton Saskatoon Vancouver
Ft. William Victoria

Canada's Departmental House for Mechanical Goods

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

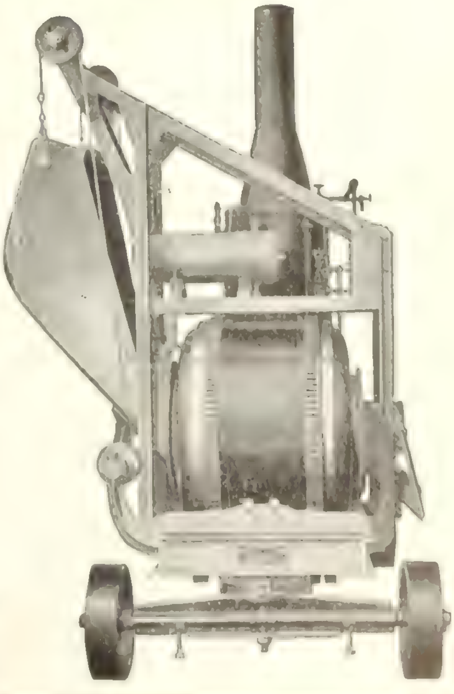
Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.



KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.

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Their efficiency has been demonstrated by their use on such important undertakings as the Hudson Bay Terminals, Welland Canal and Toronto Harbor Improvements, etc.

Where conditions demand constant and hard service, specify Napanee Hoisting Engines and Rock Drills.

The cut shows one of the many Napanee Hoisting Engines at work on the Toronto Harbor Improvements.

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It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

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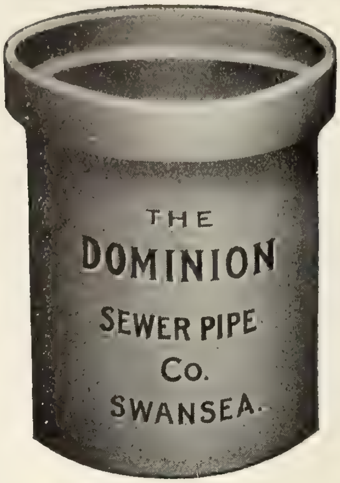

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PARK 1809

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SWANSEA (near Toronto)

Type O Thew Shovel Handles Large Output

Type O Thew on Railroad Construction

With proper facilities for removing material from shovel promptly, large outputs can be handled with a Type O Thew.

The results secured on the work shown in the cut are interesting.

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Shovel:—Type O Thew.
Contract—Grand Rapids and Northwestern R.R.

Date	Size of Cars	Cars Loaded	Cu. Yds.
April 1st	1½ cu. yd	490	612
April 2nd	1½ cu. yd.	595	744
April 3rd	1½ cu. yd.	550	687
April 4th	1½ cu. yd.	575	719
April 6th	1½ cu. yd.	375	469
April 7th	1½ cu. yd.	500	625
April 8th	1½ cu. yd.	175	219
April 9th	1½ cu. yd.	520	650
April 10th	1½ cu. yd.	370	462
April 11th	1½ cu. yd.	640	800
April 13th	1½ cu. yd.	556	695
April 14th	1½ cu. yd.	495	619
April 15th	1½ cu. yd.	393	491
April 17th	1½ cu. yd.	714	892
April 18th	1½ cu. yd.	560	700
April 20th	1½ cu. yd.	275	344
April 21st	1½ cu. yd.	510	637
April 22nd	1½ cu. yd.	525	656
April 23rd	1½ cu. yd.	555	693
April 24th	1½ cu. yd.	525	656
April 28th	1½ cu. yd.	165	206
April 29th	1½ cu. yd.	215	269
April 30th	1½ cu. yd.	350	437
Total 23 days		10,628	13,282
Average per 10-hour day		462	578

USE A THEW—IT PAYS.

Our catalogue is yours for the asking.

The Thew Automatic Shovel Company, - Lorain Ohio

Back view—Plant No. 3. New Glasgow, N.S.

Front view—Plant No 3, New Glasgow, N.S.

Sewer and Culvert Pipes

For town and city sewers in our salt glazed vitrified sewer pipe we offer the highest type of sewer material. Pipe of our manufacture have been used in practically every city in Canada. Highly glazed and perfectly vitrified.

If you are contemplating sewer construction we can quote you some attractive prices. We also make all classes of fire clay goods.

PROMPT SHIPMENT ON ALL ORDERS.

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES: **St. Johns, P. Q., and New Glasgow, N. S.**

ALSO FIRE CLAY FACTORY AT ST. JOHNS, P. Q.

Mimico Sewer Pipe

VITRIFIED AND SALT-GLAZED

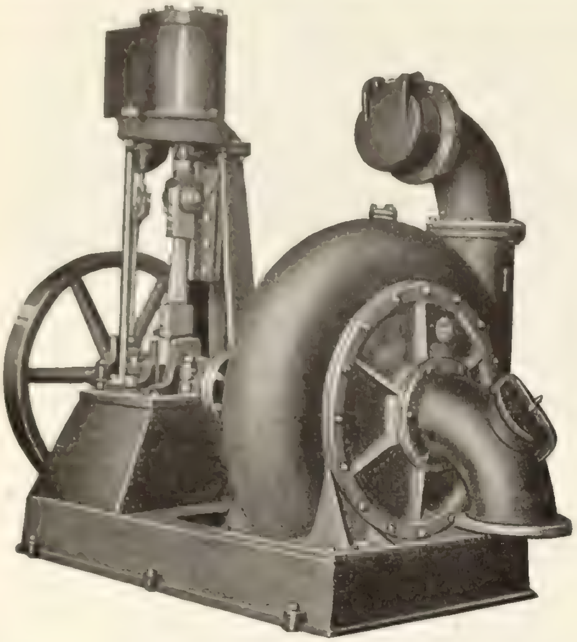
Quality

Service

ROUND PIPE AND SQUARE DEALINGS

The Ontario Sewer Pipe Company, Limited

MIMICO, - ONT.



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Complete Hydraulic Dredging Machinery
Centrifugal and Turbine Pumps for Every Service

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Portland
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Let us quote on your requirements.

Name..
Address..
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Delivery Required at..

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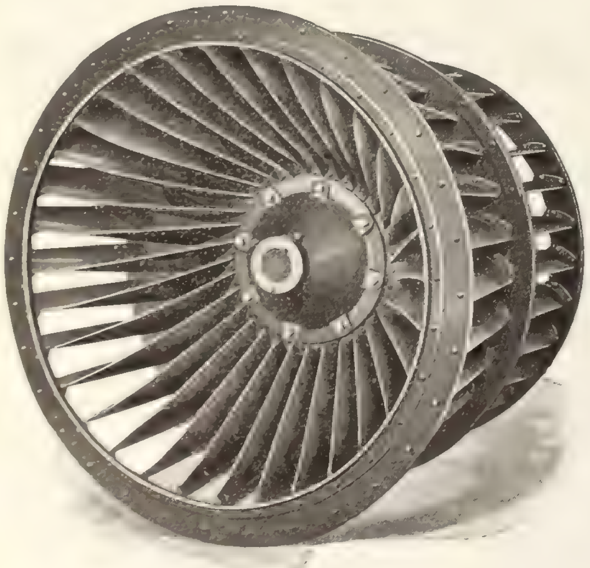

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A great advantage will be gained to consult us when considering the installation of a Heating and Ventilating System.

Our ***"Keith Fan"*** has come to the front in the Heating and Ventilating World and is considered by experts to be the most practical and economical Fan yet produced.

It will pay you to investigate ***"Keith Fans."***

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We carry in stock **Locomotives of all types, Flat Cars, Center, Side** and **Air Dump Cars, Box** and **Gondola Cars.** Can make Prompt Deliveries. Prices Low.

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The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

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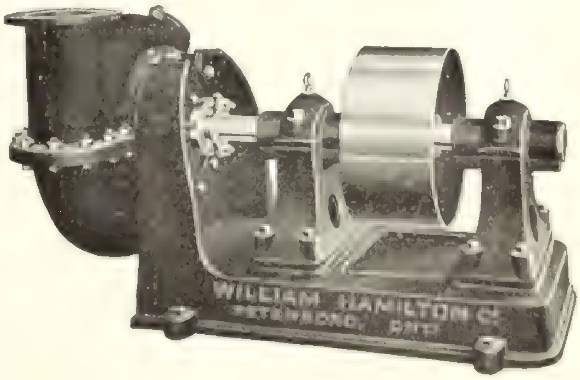

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These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

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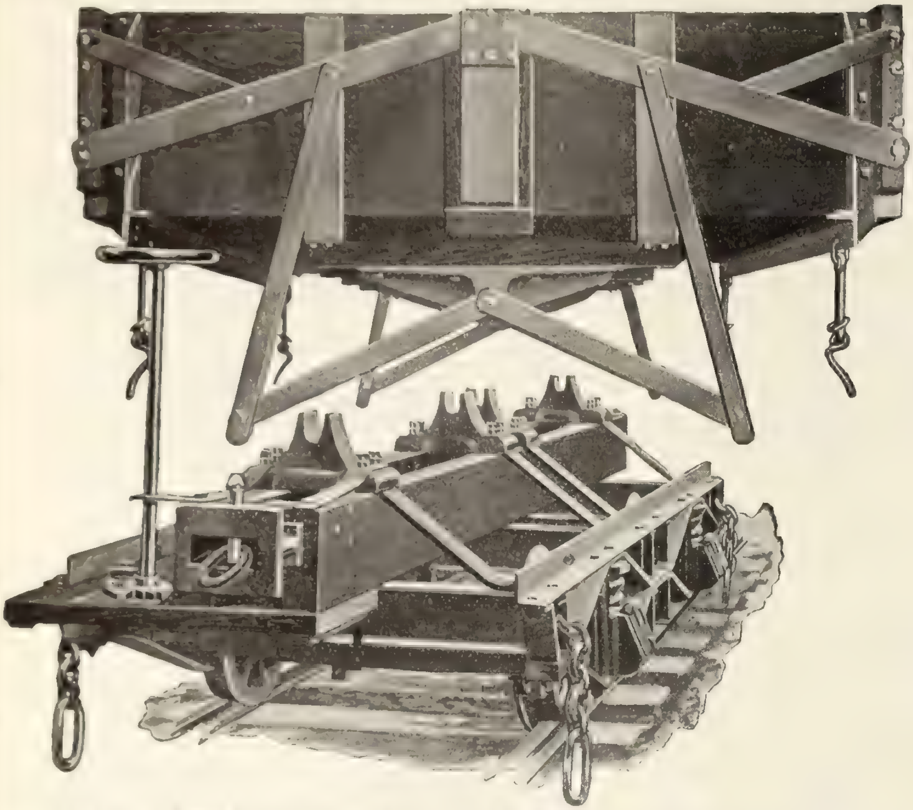

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The feature which all our cars possess, of being able to be handled like this when loading or unloading, or for putting back on track if a run-off should occur, is one which should appeal to a practical man. The entire box and dumping irons are removable immediately as shown, making less hard work and lifting. Cars are easily transported this way. No pins to loosen up or stick. The carrying bar is held fast and drops into place easily.

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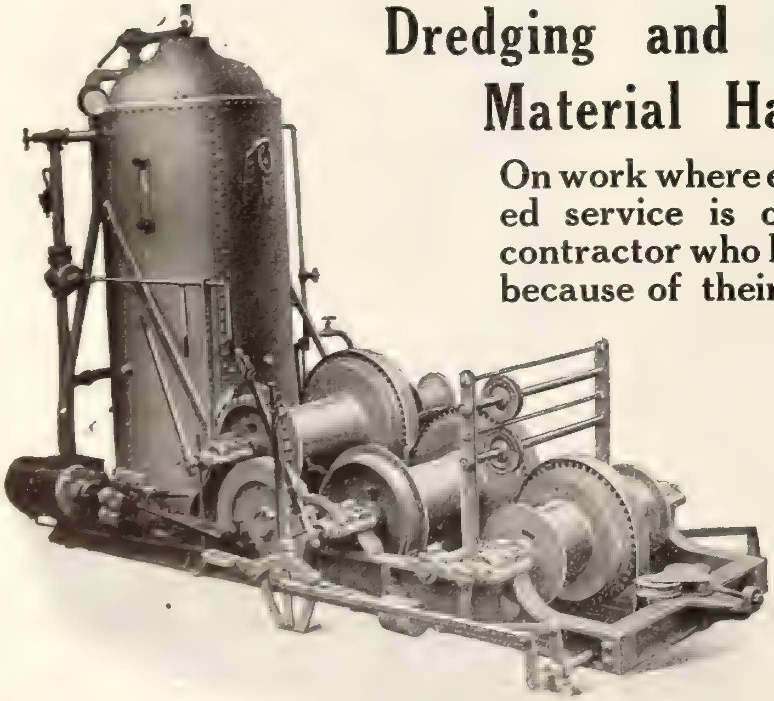

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Copper added in small quantities greatly prolongs the life of iron. Very small quantities are needed to effect this result."—Scientific American, issue of Jan. 3, 1914.

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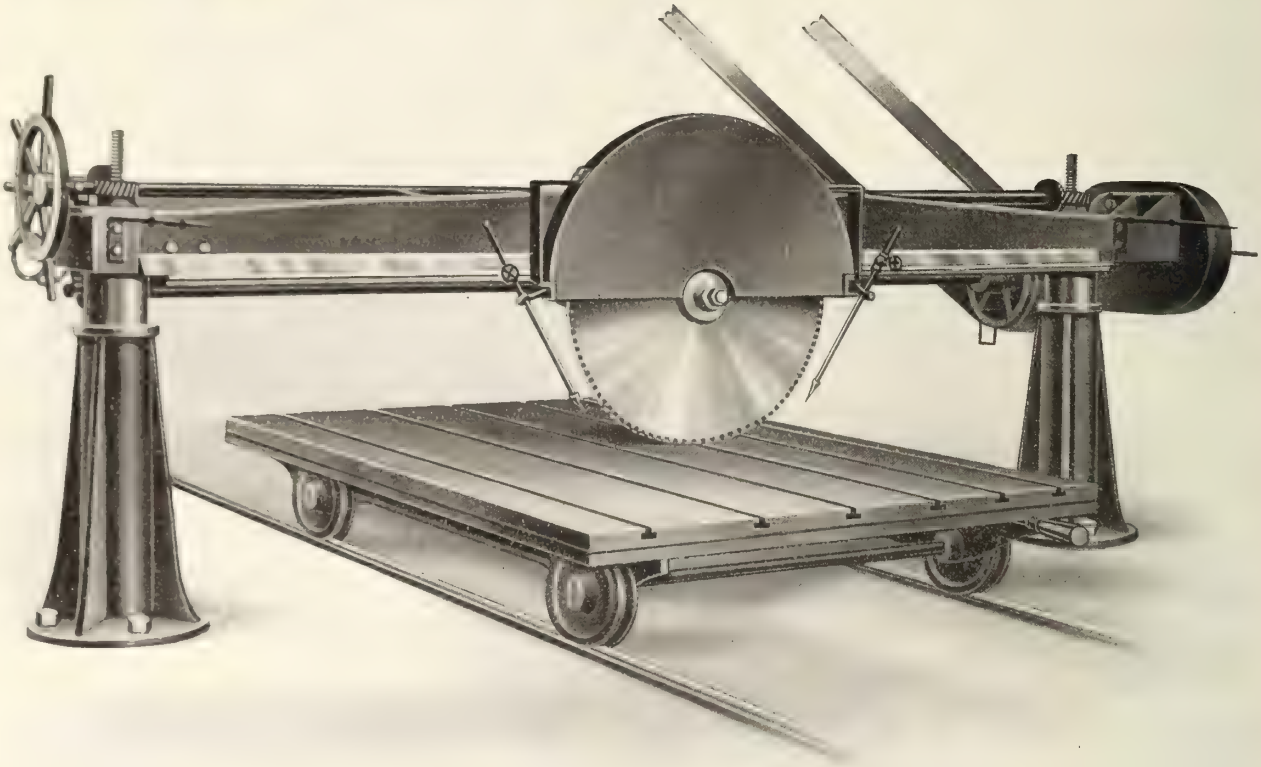

Simple of control ***Highly efficient***

Copes Marble, all four sides with one setting. Top part of table revolves and has notches for Hexagons, Octagons, as well as Squares.

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"Armstrong Special" Blast-Hole Drills are not well drills. We build well drills and have been since 1867, but we know, as do scores of successful contractors and quarry men, that well drills are not designed for and will not stand the grief of blast-hole drilling (a comparison of machines which have been in operation for a reasonable period of time will convince you). Behind our knowledge is fifty years of drill building experience—behind the experience of users is the knowledge that ARMSTRONG machines are not only more efficient, but the repair, operating and "upkeep" expense is much less, due to the fact that

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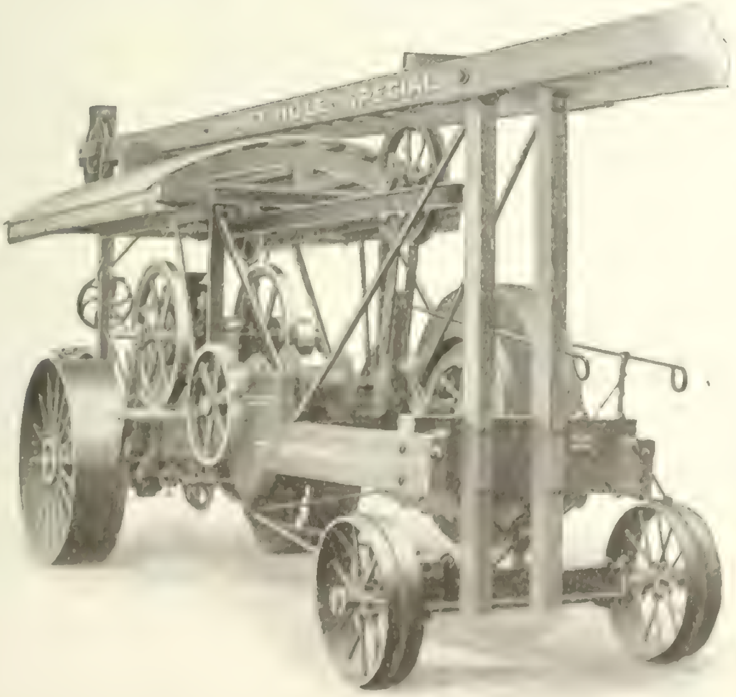
That is why it accomplishes more for the Contractor and Quarryman than any machine of any other type

Every working part of the "ARMSTRONG" Special Blast-Hole Drill is designed with direct reference to hard rock drilling. The "ARMSTRONG" spudding beam—the most important feature—gives a quick, sharp, springy blow that drills more holes at less cost than any other. The "ARMSTRONG" raises the tools as fast as they drop and *does not allow the tools to rest at the bottom of the hole* as in the case of well drills.



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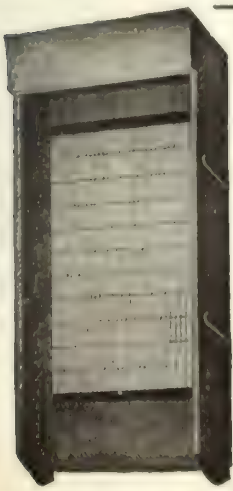

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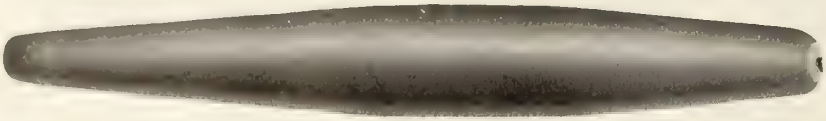

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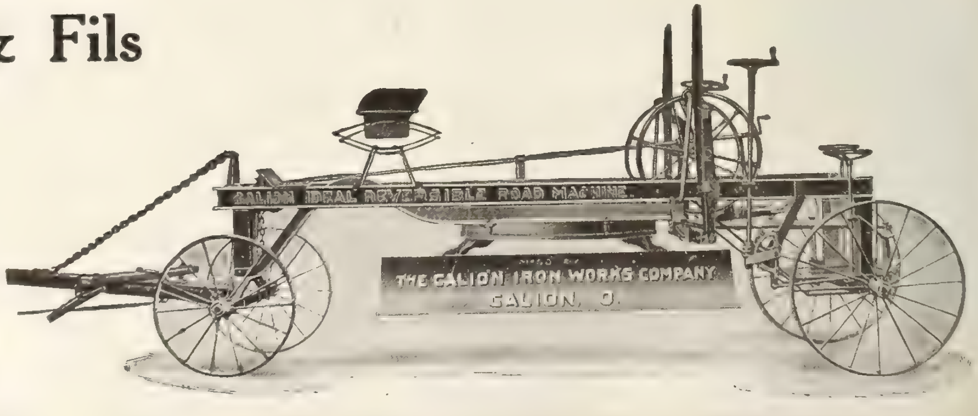
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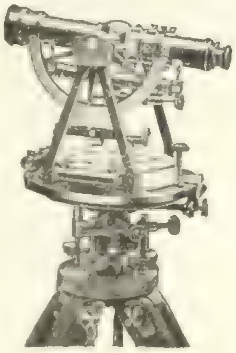

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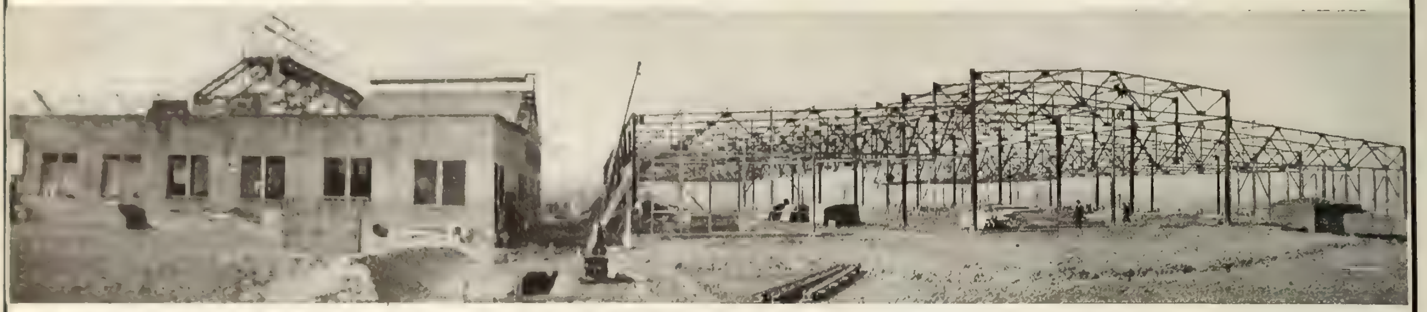
THE HAMILTON BRIDGE WORKS COMPANY, LTD., Hamilton, Canada



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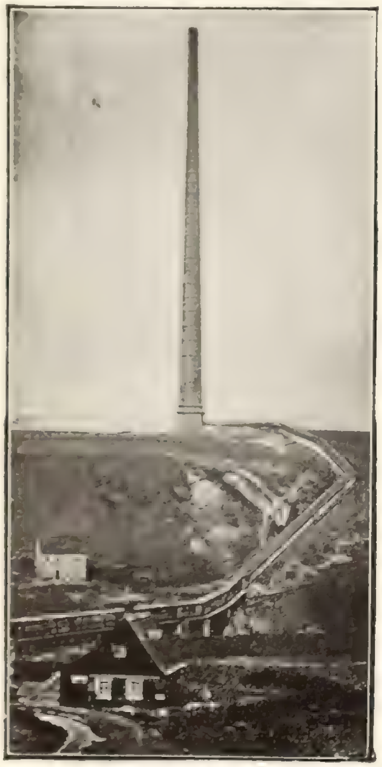
STEEL BRIDGES AND BUILDINGS



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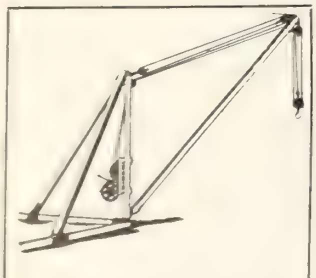

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Sasgen Derricks have been used on some of the biggest building projects undertaken and accomplished in recent years. The "A" Frame Builders' Derrick illustrated is very practical for hoisting and setting girders, iron beams, heavy joists, etc., and is a great time and labor saver : : : :

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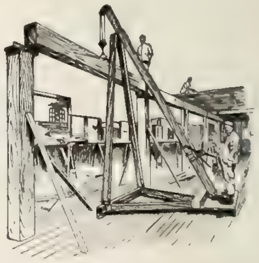

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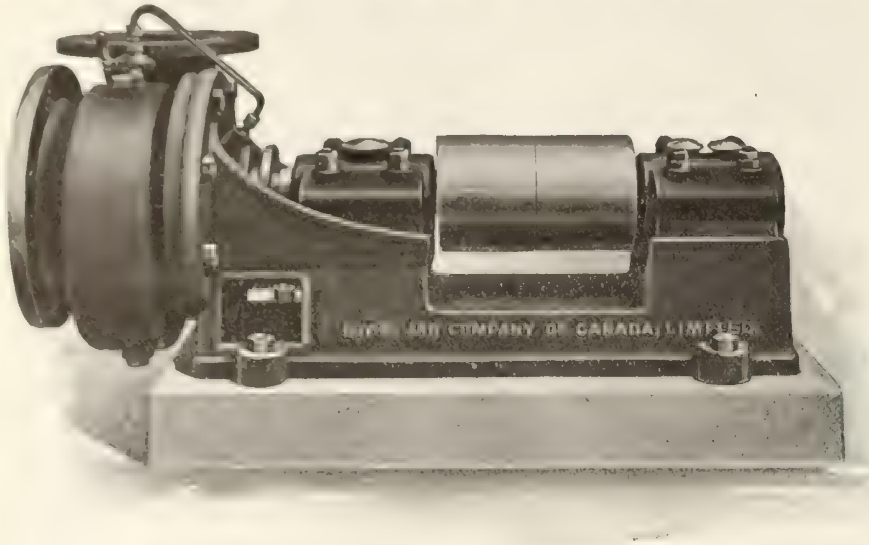

Illustration shows 10″ Contractors Pump.

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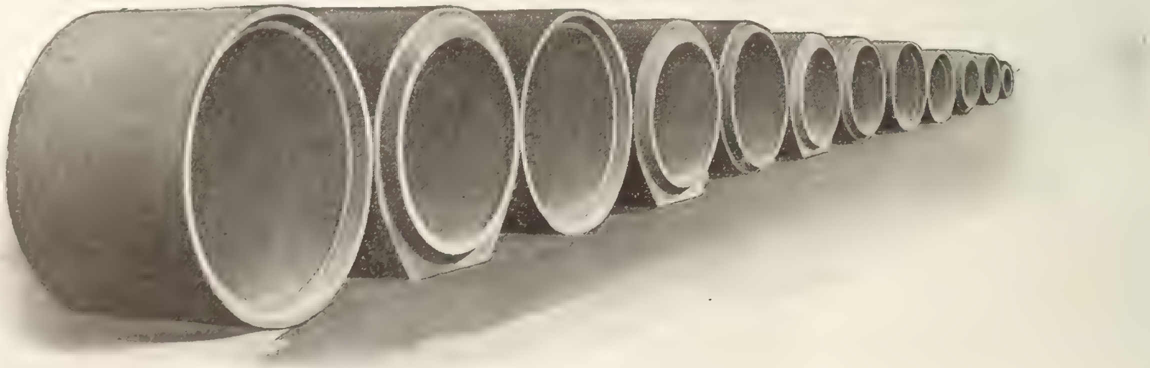

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Easily fixed, no winding and no skilled attention is required.

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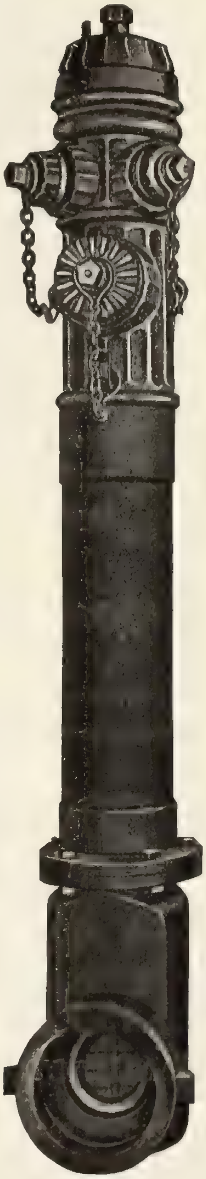

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Forty Years of Experience has much to do with the satisfaction these goods give our customers.

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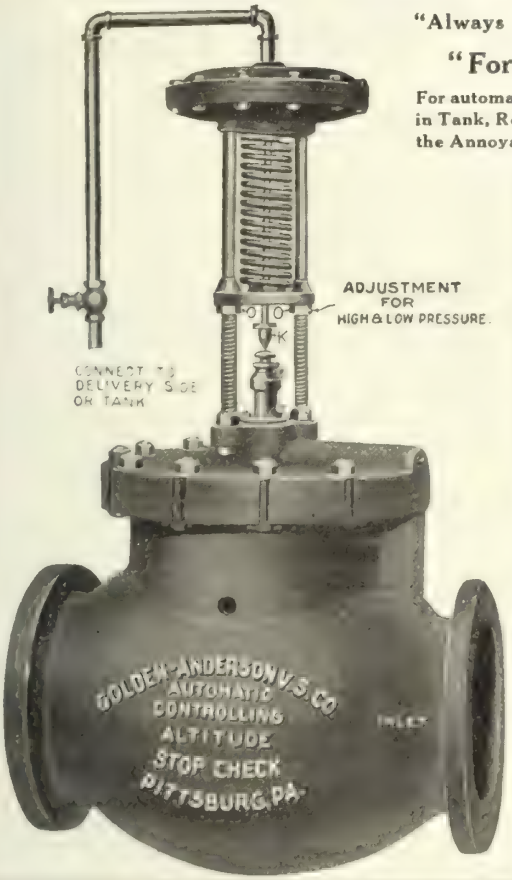
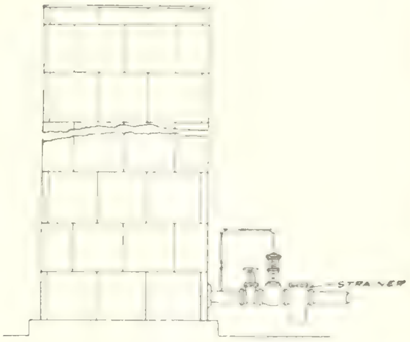
"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

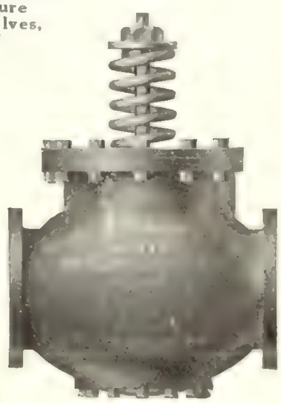
For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.



Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Automatic Cushioned Water Pressure Regulating Valves, up to 24"



Golden-Anderson Float Valves

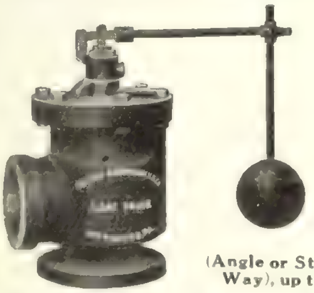


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Illustration of Electric Derrick — 6 ton capacity
Boom 65 feet. Steel Boom and Steel Mast

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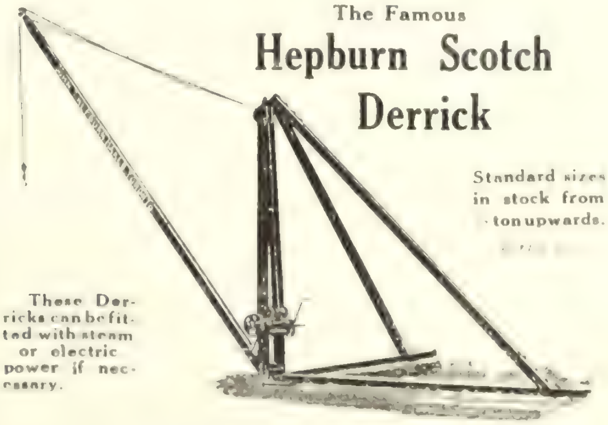

Standard sizes in stock from ton upwards.

These Derricks can be fitted with steam or electric power if necessary.

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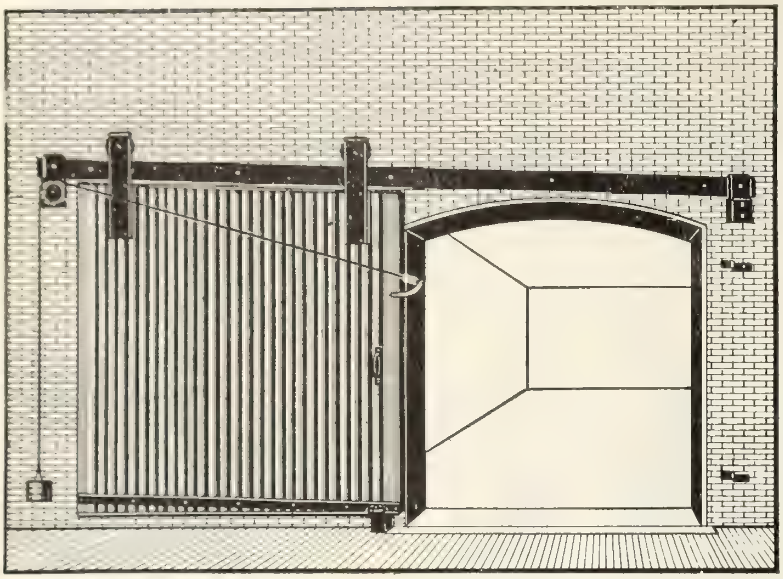

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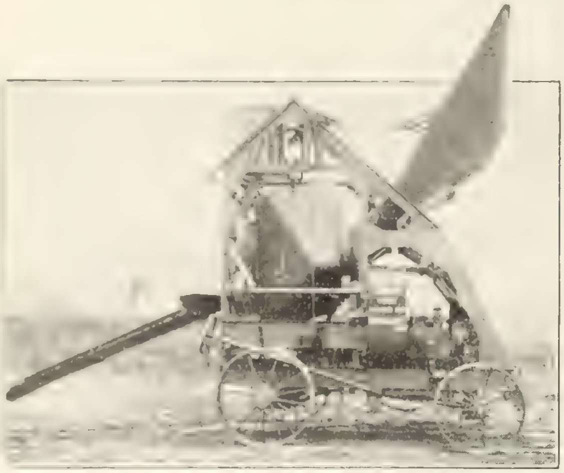

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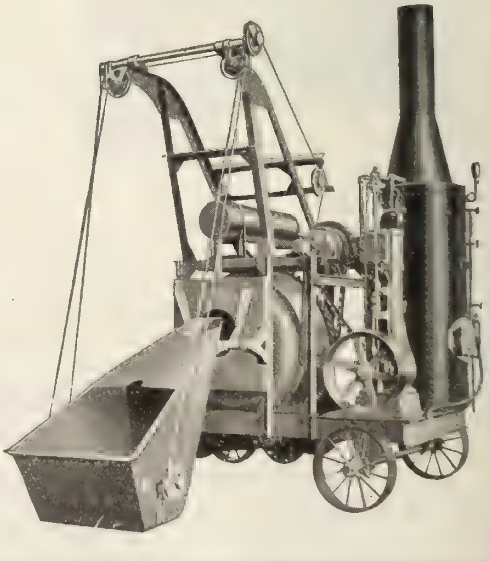

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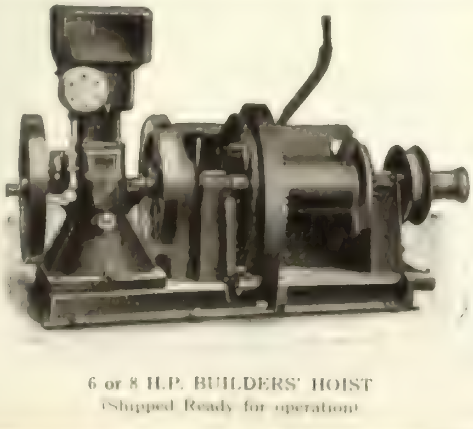

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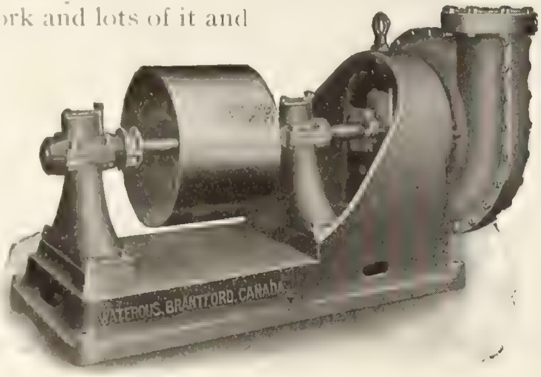

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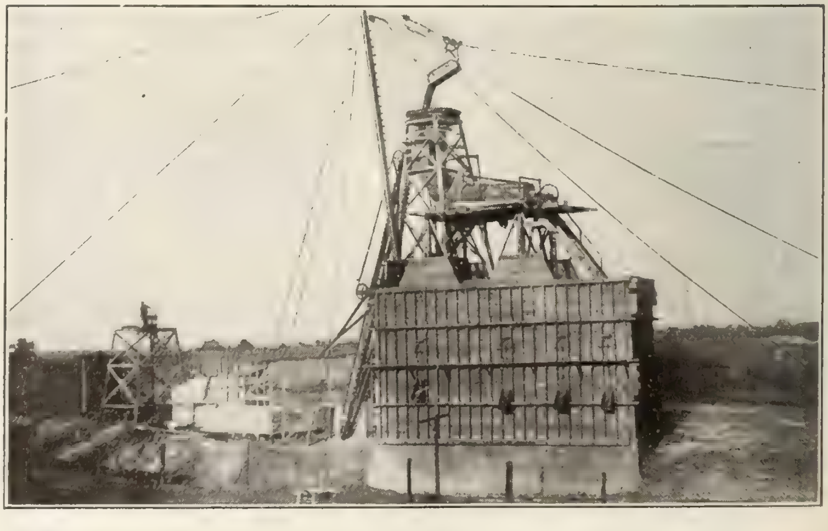

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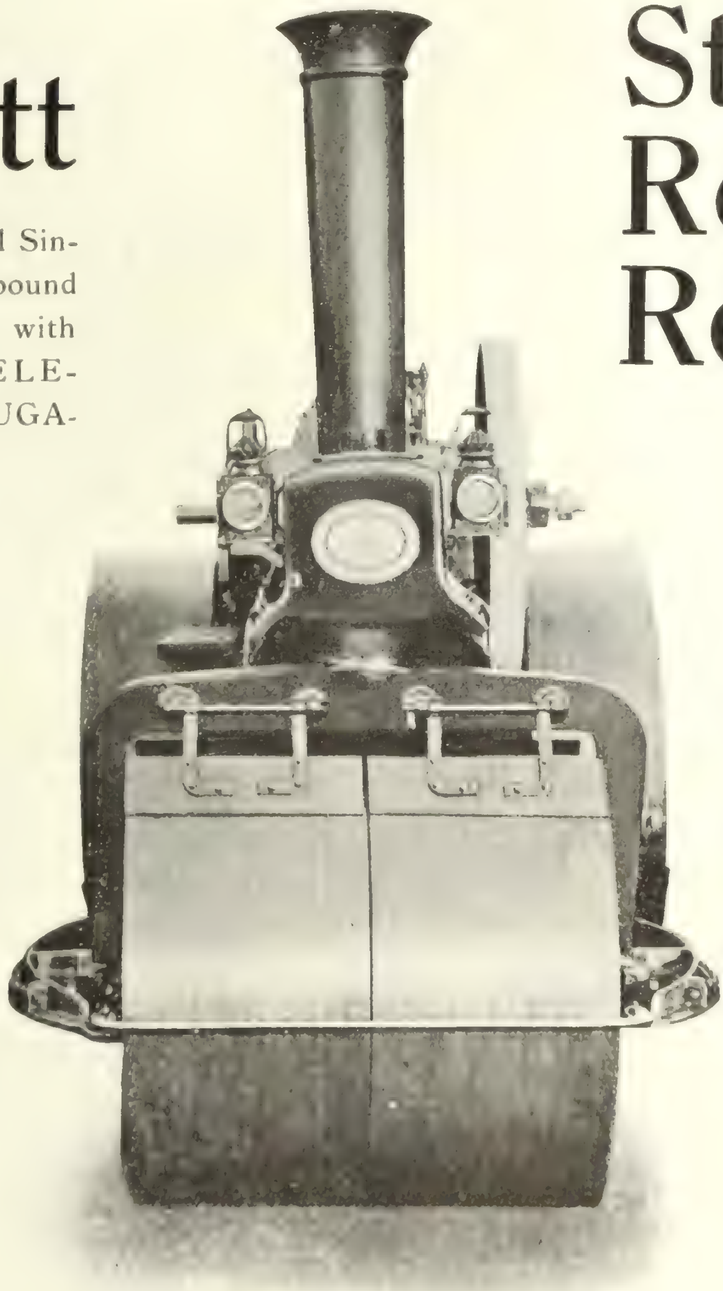

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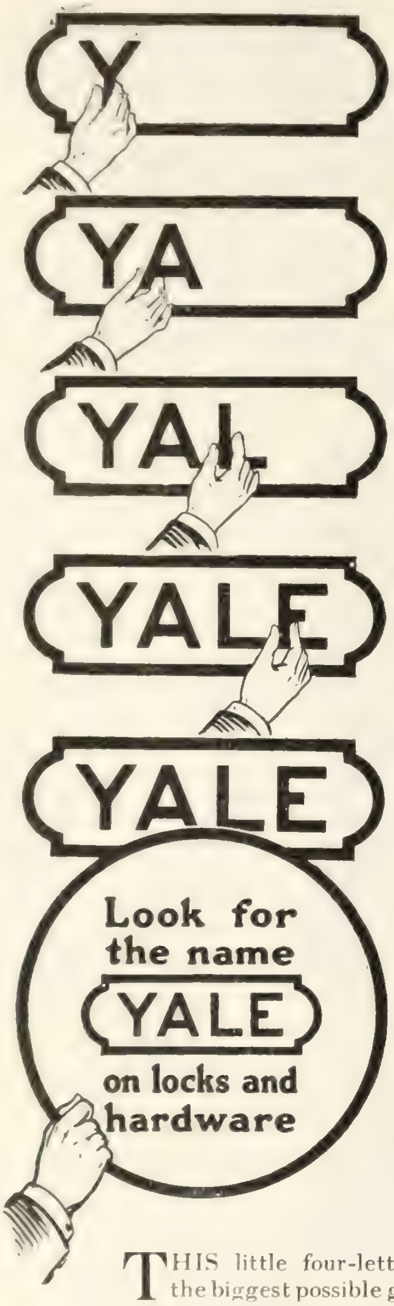

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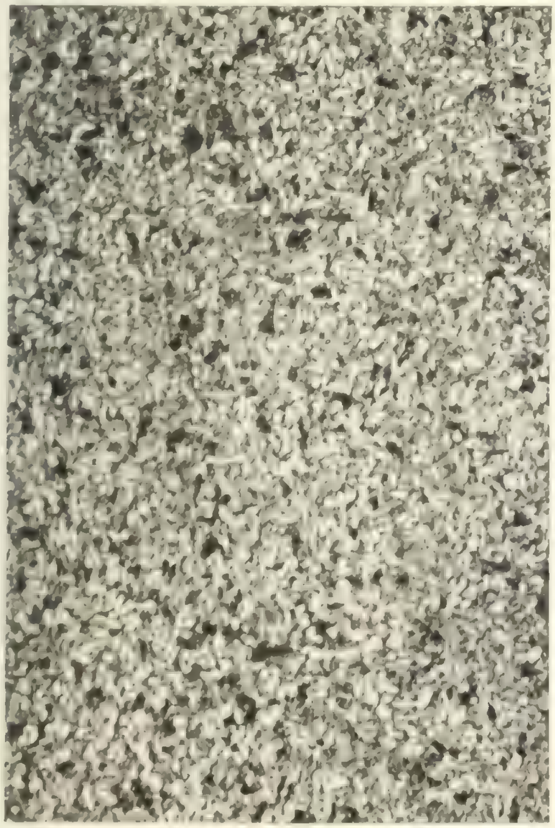

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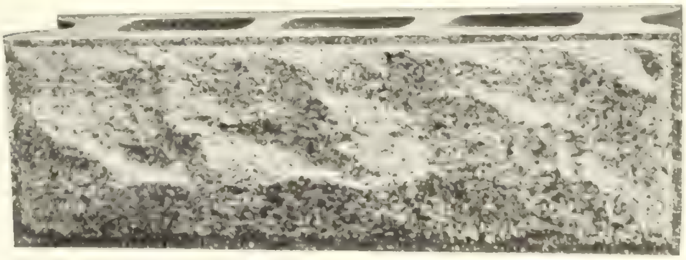

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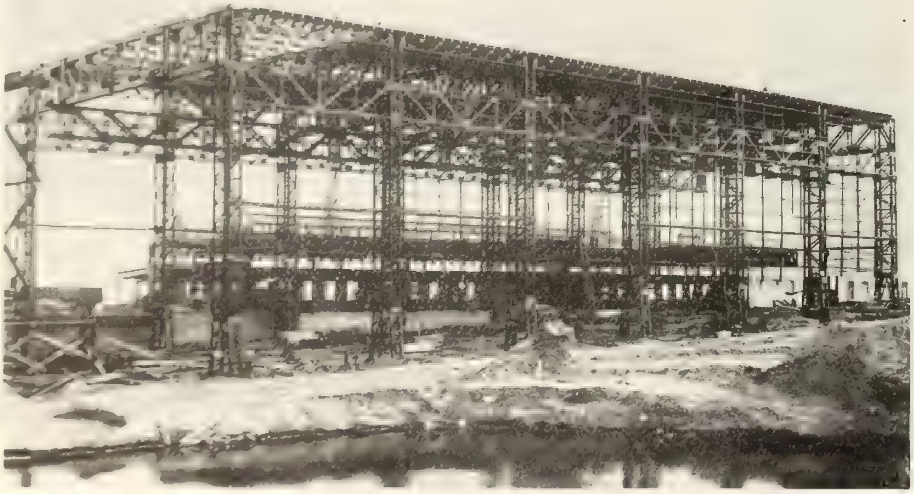

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SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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The Business Outlook

BUSINESS generally in Canada at the present time is not what most of us would have it, but it is gratifying to find leading financiers agreed that the trade depression is of a very shallow character. Not infrequently Canada has provided an almost isolated example of continued prosperity, but in the very nature of the manner in which all her important constructional undertakings have been financed, and of the increased amount of outside capital that is coming into the country, she must be susceptible to the influence of outside conditions, particularly in the United Kingdom and the United States. Much will depend upon the character and extent of this year's crops in Western Canada, but much also will depend upon outside developments.

It is recalled how the British Chancellor of the Exchequer in presenting his 1913 budget went contrary to expert opinion and predicted a prosperous year. And it proved to be right, for his estimates of revenue were exceeded by $15,000,000; the country's commerce reached a record point, and in general prosperity England surpassed her trade rivals. The success of this prophetic utterance does not necessarily ensure uninterrupted accuracy in the Chancellor's predictions, but it is sufficient to command attention. In his budget speech Mr. Lloyd George expressed the opinion that the present depression would be a shallow one and would not last long.

In the United States the conviction that the country will enter upon a decided forward movement before fall is based largely on the excellent crop outlook. And besides, the belief is growing that the period of extreme governmental and legislative attack on big business is drawing to a close. In all parts of the Union, business men have been roused by the effects of the numberless laws and projects for having Government officials forever meddling or interfering with business men. Trade and industrial activity has been artificially restrained through fear of legislative aggression. Business has been held back for months.

The United Kingdom has been affected by purely European developments and by the course of events in Mexico, Brazil and East India. In many of these cases there are signs of improvement and it can be taken for granted that Great Britain would benefit more than any other country from a pronounced revival in the United States. When the people on the other side of the border are very prosperous, British trade always benefits; and since the lowering of the United States customs tariff the British stand to gain a great deal more profitable trade. Thus, if the above forecasts or theories should turn out to be correct, we should see a good improvement in conditions in the neighboring country and in the mother country.

The question arises as to the extent to which our business would be influenced. In calculating this it is necessary to ask whether circumstances peculiar to ourselves will operate on this occasion to lessen or restrict our participation in the prosperity of the other countries. It is probably the case that conditions now prevailing in Canada would prevent any sudden upward bound on our part. Necessarily the improvement here must be gradual. A great deal will depend on this year's crops in Western Canada. A good yield would help. And if the prices received by producers are such as to give them reasonable profits so much the better. Another requisite is that the British market take our good bonds and debentures in large [illegible]

[illegible] on satisfactory terms. Perhaps it is vain to hope that our securities will command immediately a free and advantageous market abroad. English investors now think we have borrowed too much lately, and many of them have burned their fingers in Canadian propositions. So it may take a little while to re-establish our position in London. But, in the meantime, if trade in the United States and Great Britain enters a new era of prosperity, there must necessarily be a quickening of our industry and trade also.

Inefficiency Illuminated

LIFE is nothing if it be not relieved occasionally by a touch of humor. Shortcomings, municipal and otherwise, cannot fail to amuse sometimes, for inefficiency can be carried to a point where it becomes ludicrous. It is possible to pass from indignation to a state of entertained passivity.

So we feel about the town of St. John's, P.Q. In this enlightened Quebec municipality we have a correspondent whom we asked to report upon the various municipal systems in operation and to give us some information about the manner in which local affairs were administered. We had hoped to incorporate the details in the Alphabetical Reference to Canadian Towns and Cities published recently in this journal, but the communication came in tardily—not altogether to the disadvantage of St. John's, perhaps.

Below we give our correspondent's report upon St. John's, culled word for word from his letter.

Roadways.—Macadam. Mostly in a rotten state.
Sewerage.—No system. A sewer is dumped down regardless of any system and the sewage empties into the Richelieu River.
Garbage.—Allowed to collect in yards until it smells too high.
Water Supply.—From Richelieu River. About two thousand cases of typhoid and paratyphoid in the town last winter and spring.
Electric Light.—Good service.
Present Mayor.—A butcher.
City Clerk.—Efficient, but council-ridden.
Commissioners.—No-one appointed. Every councillor thinks he is one.
City Engineer.—Office held by the bailiff, chief of police and general utility man.

One redeeming feature about St. John's would appear to be the electric light service. All we can say is that we shall hope to hear before long that the administrators of the municipality have become enlightened mentally as well as physically. The above extract is illuminating as to why we found it impossible to obtain official particulars from St. John's for our Alphabetical Reference.

St. John's is a town with a population of some seven thousand. Is its record one of many or one among many?

An Experiment With a Fallacy

THE strikers in the Federation of London Building Industries have taken over the contract for the new structure for the Theosophical Society—a building which involves the expenditure of [illegible]

The move is a socialistic one and we are told that its end is the elimination of the contractor. This idea has been popular in British labor circles, but it has been difficult to get it under way owing to the fact that all building materials in England are controlled by syndicates whose interests are bound up with the contractors. There are eleven unions in the Federation, but funds are low owing to the fact that the strike has been in progress for more than four months.

It will be interesting to watch what success attends this latest socialistic development in the old land. It is possible that the officials at the head of the unions are sufficiently able men to take over the duties of the contractor and that the emoluments which they receive are sufficient inducement for them to do so, but it is safe to assume that in this instance, as in all others, the profit to which the contractor is entitled legitimately by virtue of his skill and experience will go somewhere—that it will be squandered at least in part, and that those who expect to benefit from the scheme will be disappointed.

Success in any enterprise is dependent upon efficient business administration. From such efficiency alone, provided their interests be sufficiently protected, can employees in the building or any other trade hope to benefit. The history of administration by social reform bodies has not been an encouraging one.

Mr. H. K. McCay, the city engineer of Baltimore, gives an interesting account of the efforts made to protect steel bridges over railways against the corrosive action of gases and cinders from locomotives. In the case of two important bridges it was found that the lower members were badly corroded in spite of frequent repainting. Consequently, the girders have been encased in reinforced concrete, which has been applied for the same purpose elsewhere with highly satisfactory results.

The supplementary estimates tabled at Ottawa total $17,438,912. An important item is $655,000 for the construction and completion of a dredging plant in the River St. Lawrence. There is a vote of $100,000 for harbor works at Goderich. One million is provided for the N. T. R., one million for the Quebec Bridge, and one million for the Welland Canal work. The sum of $500,000 is placed in the estimates for Port Arthur and Fort William harbor improvements, and the same amount is set aside for similar work at Quebec. For harbor works at Hamilton the sum of $250,000 is appropriated and for wharves in the Winnipeg harbor $200,000. A large sum will be spent upon the erection of public buildings and extensions to existing structures.

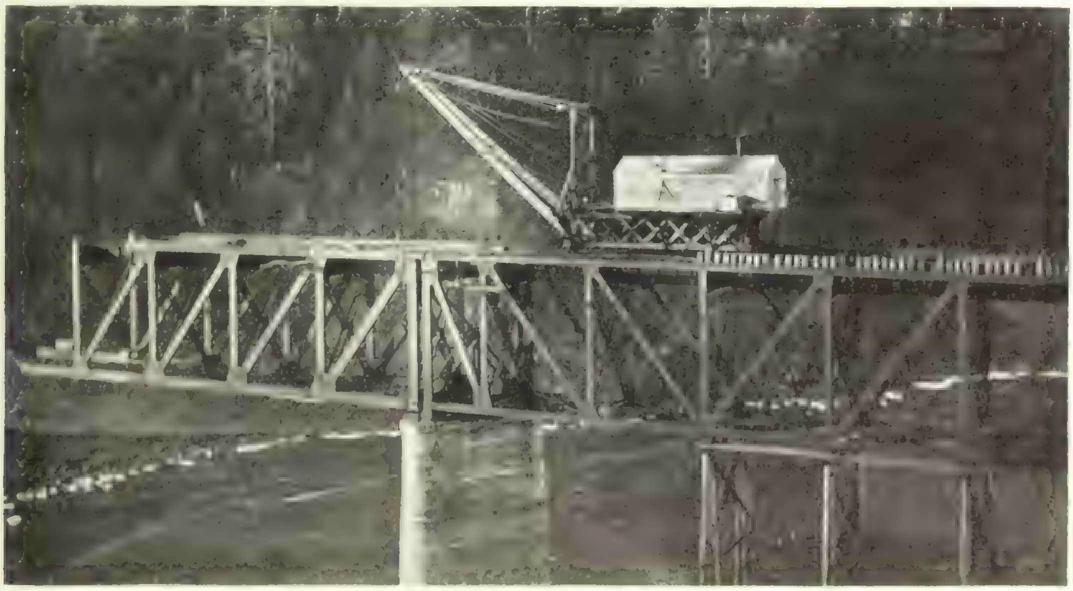
In an editorial note on fire-proof construction, the Sanitary Record points out that in fire after fire it has been demonstrated that unprotected ironwork only helps to destroy buildings "by expanding and pushing out the walls or yielding under the heat and pulling them down." After referring to slow and costly experience of so-called methods of fire-proofing, our contemporary makes the following remarks upon reinforced concrete:—"Whatever may be the opinion of architects as to its adaptability, there is no doubt that its proved fire-resisting and other desirable qualities ought to secure its use for the structural portion of all large buildings. We are afraid, however, that safety alone is not a sufficient inducement to adopt it, and not until architects and capitalists find that it is really an economical method of construction and makes a good foundation for adornment, shall we see it as widely used as we think it should be."

The Canadian Northern Pacific Railway Bridges of British Columbia

Specially Contributed by John Lyle Harrington[*]

THE Canadian Northern Pacific Railway, coming east from Vancouver, crosses the Fraser River at New Westminster on the bridge built in 1904 by the Province of British Columbia, and proceeds up the southerly bank to Cisco, where it crosses again to the north side of the river, only to return at Lytton. It then proceeds up the Thompson River, crossing it seven times, and crosses at its mouth and continues up the North Thompson River. Between Yale and Cisco the road crosses on steel spans and trestles nine creeks which enter the Fraser River from the south.

The earlier construction of the Canadian Pacific Railway secured for it the easier course up the north side of the Fraser River to its crossing at Cisco and thence up the southerly side of the Fraser and Thompson Rivers, but the difficulties of construction involved by the less advantageous course remaining unoccupied were greatly increased by the adoption by the Canadian Northern Pacific Railway of low gradients and very easy curves. The narrow, rough canyons compelled the line to cross the rivers frequently, often on curves and at points where construction was difficult and expensive. At most of the crossings the rivers are so swift and their flood depth so great that the construction of foundations was difficult and the erection of superstructures by means of the usual false work impossible. The plant and materials for the construction of the foundations for spans and viaducts between Yale and Cisco had to be taken across the swift and treacherous Fraser, sometimes by boat and often by overhead cable. Add to these a sparsely-settled country, scant means of communication, and distant sources of all labor, material and supplies, and the difficulties encountered in constructing so large an amount of bridge work are rarely equalled.



C. N. P. Railway Bridge, No. 2

In the main, the structures themselves are not unusual. All have concrete foundation and steel superstructures with timber floors, designed for single track class heavy loading and in accordance with Dominion Government specifications.

Creek Crossings

Bridge No. 11 consists of two 35-ft. girder spans and one 90-ft. span, supported on abutments and a single trestle tower.

Bridge No. 12 has a total length of 910 feet and is made up of 35-ft. and 70-ft. girder spans on steel towers, having a height of 107 feet from base of rail to masonry. The entire structure is on a 4-degree curve.

Bridge No. 13 is 720 feet long and 105 feet from base of rail to masonry, and is made up of 40-ft. towers and 40-ft., 60-ft. and 80-ft. deck-plate girder spans. Bridge No. 14 is about 300 feet long, 100 feet high, and consists of 40-ft. towers and 40-ft. and 90-ft. deck-plate girder spans. Bridge No. 15 consists of one 35-ft. and one 90-ft. deck-plate girder spans resting on masonry. Bridge No. 16 is a single 75-ft. girder span. Bridge No. 17 consists of one 50-ft., one 90-ft. and one 15-ft. girder span, all resting on masonry. Bridge No. 18 consists of one 70-ft. girder span. Bridge No. 19 is one 60-ft. girder span.

Bridge No. 1

Bridge No. 1 crosses the Fraser River at Cisco, where the stream is narrow, the water is swift, and the variation between low and flood water is substantially 80 feet, and where, consequently, false work is impossible. It consists of about 350 feet of steel trestle approach on the east end, and a three-hinged spandrel-braced arch, 425 feet long, centre to centre of end pins, having a rise of 90 feet and a truss depth of 20 feet at the centre and 110 feet at the end. The distance centre to centre of trusses is 14 feet, and they are battered 1½ inches per foot.

The foundations are comparatively inexpensive, for on the east side the skewback is placed on solid rock, approximately at the elevation of high water, although on the west side of the river it was necessary to excavate several thousand cubic yards of loose or dis-

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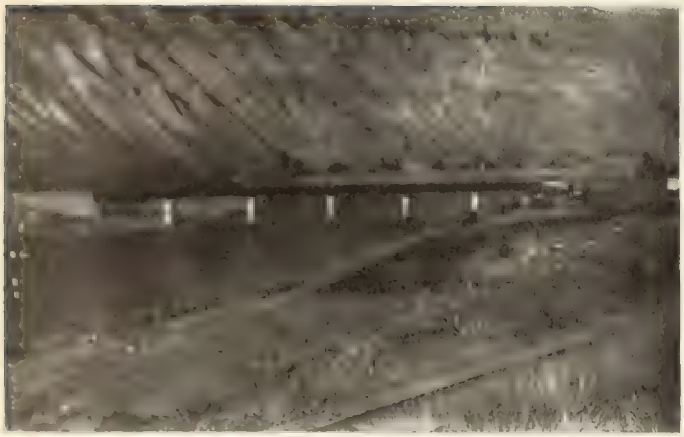
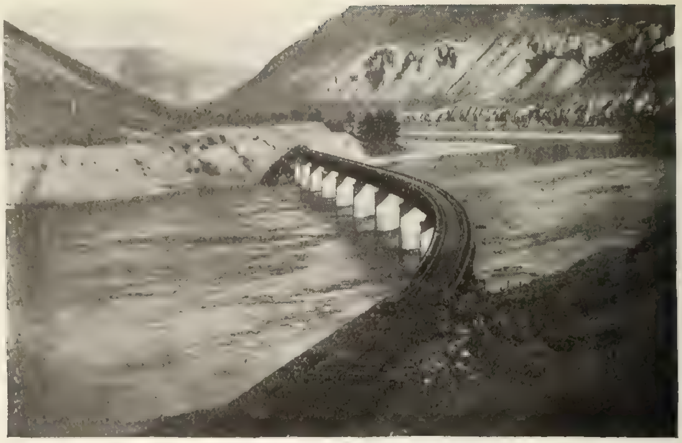
[*] Of the firm of Messrs. Waddell & Harrington, Consulting Engineers, Kansas City, Mo.



C. N. P. Railway Bridge No. 6



C. N. P. Railway Bridge No. 7

integrated rock to secure satisfactory foundation in the face of the bluff, which at that point is almost sheer.

The superstructure will be received on the Canadian Pacific Railway tracks on the east side of the river. The easterly half of the arch will be erected as a cantilever supported by temporary counterweights bearing on the skewback. The material for the west half of the arch will then be carried out over the east half and run across to the west shore on cableways extending from the middle panel point of the arch to the west skewback. From the cableways it will be lifted by the traveller as needed in the erection of the west half of the arch, which will be erected as a cantilever, from temporary anchorage in the solid rock of the bluff. Fig. 1 is an elevation of the bridge.

Bridge No. 2

Bridge No. 2 crosses the Fraser River at Lytton, which is just below the mouth of the North Thompson River. It has a total length of 805 feet, consisting of two 68-ft. deck-plate girder spans at the easterly end, a mid-river span of about 295 feet flanked by two truss spans of about 155 feet each, and two deck-plate girder spans, each about 60 feet long, at the westerly end. The crossing is on a skew of about 65 degrees. The distance between low water and the base of rail is about 126 feet, and between low and high water about 70 feet. The piers are therefore very high, but since the foundations are shallow their construction otherwise involved no extraordinary difficulties.

The girder spans are being placed in the usual way. The 155-ft. deck truss spans are being erected on falsework, but the 295-ft. central span is being erected as a cantilever, one-half from each side, supported during construction on the 155-ft. span.

Bridge No. 3

Bridge No. 3 crosses the Thompson River at its mouth. It consists of an 82-ft. girder span at the southerly end, three truss spans of about 152 feet each over the main river, and a 60-ft. girder span at the northerly end. All are of deck construction. The distance between base of rail and low water is approximately 121 feet and the water at flood rises about 64 feet.

The piers are high, but are founded on solid rock almost at the elevation of low water. Only small cofferdams were required and the construction of the foundations involved no particular difficulties.

The height of the structure and flood conditions render the use of false-work dangerous, hence to erect the truss spans it is planned to place with a derrick car four light trusses braced together and lying just below the plane of the lower chords of the main trusses. The trusses, with enough bracing to steady them, will then be erected by the derrick car, which will not leave the adjacent span. As each panel is erected the portion then erected will be hauled or jacked out upon the light temporary trusses until the entire span is in place. This method of erection is novel, but there is no apparent reason why it should not be employed successfully.

Bridge No. 4

Bridge No. 4 crosses the Thompson River where it is comparatively broad and shallow. The structure consists of six light deck truss spans and has a total length of 844 feet. The bed of the river is made up

C. N. P. Railway Bridge No. 10

largely of hard gravel and boulders, therefore the piers were sunk by the pneumatic process.

Span No. 6 was erected on false work in the usual manner, but spans Nos. 5, 4, 3, 2 and 1 were erected successively as cantilevers, each span being carried by the one previously erected. Though the water is shallow, it is too swift to make the use of false work safe, for it would be impracticable to drive piles in the boulders which constitute the river's bottom, and the use of sunken bents is always precarious.

Bridge No. 5

Bridge No. 5 crosses the Thompson River in a narrow gorge, where the depth of water is great, the current is swift, the difference between low and flood water is 32 feet, and the river bottom is too rough and ragged for the use of false work, even if the current would permit it to be employed; therefore the bridge, which consists of one 35-ft. deck-plate girder span, and a single through truss span, 210 feet in length, was erected entirely from one side, the truss span being erected as a cantilever. The foundations are simple and not especially noteworthy.

Bridge No. 6

Bridge No. 6 cross the Thompson River where it is swift but comparatively shallow. It consists of six 90-ft. deck-plate girder spans, resting on concrete piers, which were sunk by the pneumatic process because the river bottom is made up largely of boulders and coarse gravel. The crossing is on a severe skew and on a curve. The girders were erected by means of a derrick car and the construction involved no unusual difficulties.

Bridge No. 7

Bridge No. 7 crosses the Thompson River where it is comparatively shallow, on a skew and on a curve. It has a total length of 1,046 feet between abutments and is made up of twelve 88-ft. deck-plate girder spans, resting on piers sunk by the open dredging process and supported on piles. The structure is shown in one of the illustrations.

Bridge No. 8

Bridge No. 8 crosses the Thompson River on a skew where the river is broad and shallow, the current swift and the bottom somewhat subject to scour. It has a total length of 1,104 feet between abutments and is made up of ten deck-plate girder spans, each about 93 feet long, with an 86-ft. deck-plate girder span at each end. The piers rest on hard, tough clay and are protected from scour by rip-rap. They were sunk through the overlying sand and gravel by the open dredging process.

Bridge No. 9

Bridge No. 9 crosses the Thompson River where it is comparatively broad and shallow. It consists of a 200-ft. through truss span at the easterly end of a group of six deck-plate girder spans, of which five are about 90 and one is 80 feet long, supported on concrete piers sunk by the open dredging process. Where hard material was found at reasonable depth, the piers rest directly upon it, but where there was much sand and gravel, the piers are supported on piles. The crossing is on a skew and on a curve, but the water is shallow and the superstructure will be erected by usual means.

Bridge No. 10

Bridge No. 10 crosses the broad, shallow mouth of the North Thompson River, where it is navigable. The total length of 1,200 feet is made up of thirteen

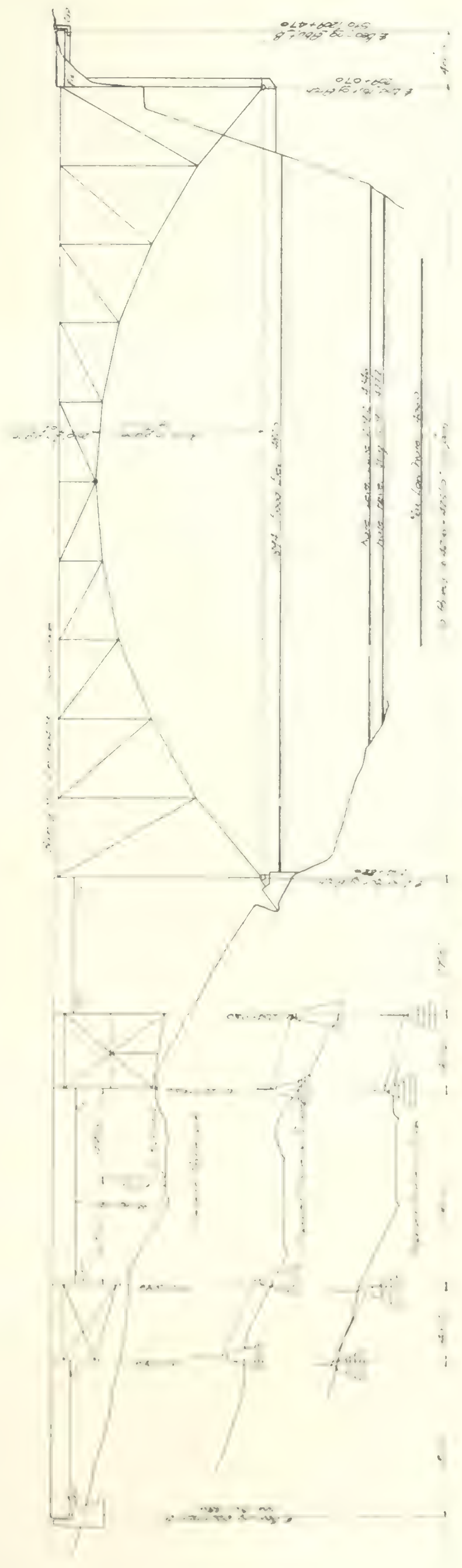


Fig. 1. Elevation of C. N. P. Railway Bridge No. 1 over the Fraser River near Lytton, B. C.

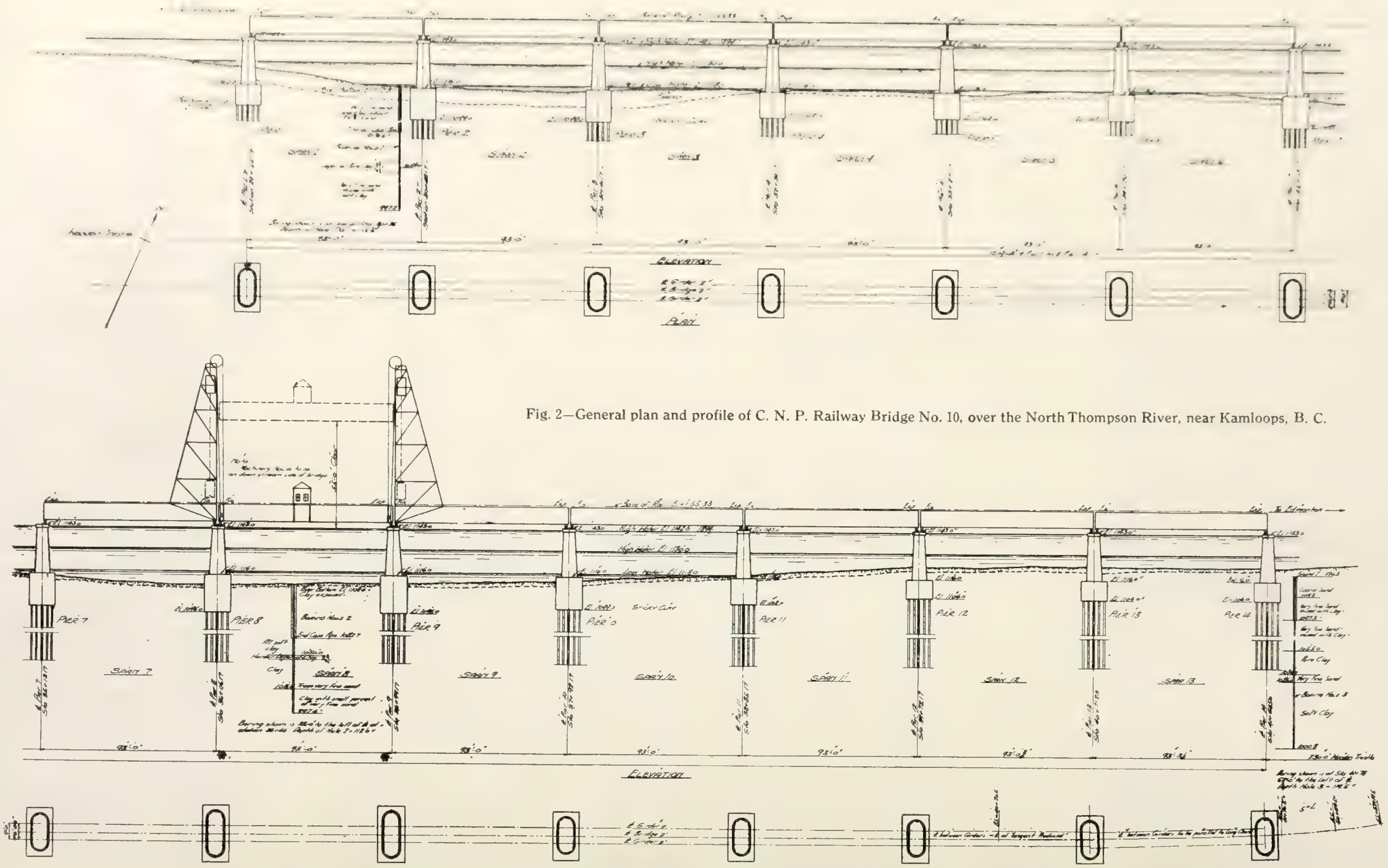


Fig. 2—General plan and profile of C. N. P. Railway Bridge No. 10, over the North Thompson River, near Kamloops, B. C.

The Canadian Northern Pacific Railway Bridges of British Columbia.

deck-plate girder spans, resting on concrete piers. The bed of the river is composed largely of sand and gravel, hence the piers were sunk by the open dredging process and are supported on piles.

To provide for navigation, one of the girder spans is designed to lift vertically to afford a clearance of 55 feet above high water and a horizontal clear opening of about 75 feet. The span is fully counterweighted, hence it is easily raised and lowered by small gasoline engine. As is usual with the vertical lift bridge, the weight of the span and counterweight is transmitted directly to the piers by the front bents of the towers. The back braces which are connected to the adjacent spans, carry wind load only. One of the illustrations affords a view of the bridge ready for service, while the general plan and profile (Fig. 2) are reproduced on the opposite page.

The bridges were designed and their construction was supervised by Messrs. Waddell & Harrington, for Messrs. Mackenzie, Mann & Company under the general direction of Mr. T. G. Holt and Mr. T. H. White, respectively Vice-President and Chief Engineer. The substructures of bridges Nos. 1, 2, 4, 5, 6, 7 and 19 were constructed by Messrs. Armstrong, Morrison & Company, of Vancouver. The contractors for the substructures of Bridge No. 3 were The John Galt Construction Company, of Winnipeg, and for Bridges 8 and 9 The Graff Construction Company, of Seattle. The contractors for the superstructure of Bridges 1, 2, 3, 5, 9 and 10 are The Dominion Bridge Company, of Montreal, and for Bridges Nos. 4, 6, 7, and 8 The Canadian Bridge Company, of Walkerville, Ont. The contractors for the spans and trestles between Yale and Cisco were as follows: substructure, Messrs. Boyles & Company, of Vancouver; fabrication and delivery of metal for superstructures, United States Steel Products Company; erection of superstructures, Messrs. E. E. Davis & Company.

Modern Tendencies in Equipping and Operating Structural Shops

It is essential that the designer, the detailer and the builder thoroughly understand the character of the equipment and the procedure followed in structural steel shops. Unless one is closely connected with the operation of such shops it is difficult for him to appreciate the constant changes in equipment and methods. As the writer has recently visited a number of the leading structural shops in the United States and Canada and has had considerable experience in such shops in the past he will record some of the impressions created.

The greatest progress has been made in the methods and equipment for handling materials, as it is now realized that decreasing the number of operations required to fabricate a member is extremely important. The manner of storing, loading and unloading materials, and the transfer of them to and from the machines are even more important factors than the speeds of the various machines, although the use of high-speed tool has increased considerably. One marked change has been the development of heavy-duty machines for massive work. Shears, bending rolls, straighteners, saws and punches now have much greater capacities. In connection with multiple punches one of the most interesting developments has been the automatic spacing tables in use in some shops. Coincident with the use of heavier machines there is a marked tendency to separate the facilities for light and heavy work. Although this requires a greater floor space, and thus increases the overhead expenses, the increased production has resulted in lower unit costs. The operation of the large-capacity machines for light work is a very wasteful procedure.

Especially in the smaller shops, the use of combination machines, such as machines for shearing and punching, for sawing and rotary planing, for bending and straigthening, etc., has greatly increased. The small combination shearing and punching machines are extremely useful as they can also be taken into the field and used for such emergency service as is unavoidable in erection work. The sawing and rotary planing machines are in some shops displacing friction saws, as the planer face can be used for a number of operations.

Radial extension drills, operating from long arms which may be attached either to the walls or may be swung completely around a column, have come into extensive use. Heavy pneumatic rivetters, carried by a crane which is in turn mounted on a truck, are in use in some shops. The truck runs on a track, and is operated by means of an electric motor. The increasing use of tough alloy steels for the rivet sets has reduced the breakage caused by the punching of thick plates. The increase in the use of large horizontal milling machines is marked. Several of these machines have a travel of from 30 to 40 ft., the plates being held tightly in position by pistons operated from pneumatic cylinders. Rotary planing machines are growing in favor, and duplex adjustable planers are now arranged for planing both ends of long members at the same time. An interesting development has been the milling machines, which have recently come into use for finishing the ends of braces and stiffeners and for chamfering the corners of angle braces. One of these tools is so constructed that it will mill, simultaneously, both ends of two angles. Machines for boring pin holes at both ends of long compression members are also in use, and have been developed to a high degree of efficiency.

Electric drive has now come into almost universal use, and with it there has come more complete pneumatic systems. Most of the larger machines are operated by separate motors, but it is quite common practice to connect several of the smaller machines by shafting, and to operate them from a single motor. Locomotive cranes are being used more and more for yard service and to transport the material to and from storage. The use of magnets suspended from travelling cranes or from the booms of locomotive cranes has effected economy in some plants. Although travelling electric cranes, which span the bays of structural shops, have increased in efficiency and capacity, wall cranes, column cranes and monorail hoists are being used to an increasing extent. The development of monorail systems has been especially marked.

The improvement in the construction of the shops themselves cannot be overlooked. The increasing use of metal frames and sashes has resulted in much better lighting systems, and the ventilation facilities have also greatly improved. In this connection the efficient plant of the St. Lawrence Bridge Company, which was built and equipped expressly for the construction of the new Quebec Bridge, is worthy of note. The large number of special and efficient machines contained in this plant are of particular interest to anyone interested in the fabrication of steelwork. Considering the economic side only, it is hardly probable that the building of such an elaborate plant as this for the construction of a single bridge is justifiable.—Engineering and Contracting.

Modern Bituminous Surfaces and Pavements

By Arthur H. Blanchard[*]

BITUMINOUS pavements have been in use in American municipalities for nearly fifty years, but the introduction of modern bituminous surfaces and bituminous pavements in the construction of highways outside of built-up districts is of comparatively recent origin in America, dating from about 1906. This point is well illustrated by the fact that in 1908 the total yardage of bituminous surfaces and bituminous pavements constructed under the jurisdiction of the eight leading state highway departments in the eastern part of the United States was only 416,700. Since that period the growth of the use of bituminous materials in the construction and maintenance of roads and pavements has been exceedingly rapid.

In order to avoid misunderstandings the various methods of using bituminous materials referred to in this paper will be explained by the following definitions:

> Bituminous surfaces are those consisting of superficial coats of bituminous materials with or without the addition of stone or slag chips, gravel, sand or materials of a similar character.
>
> Bituminous macadam pavements are those consisting of broken stone and bituminous materials incorporated together by penetration methods.
>
> Bituminous gravel pavements are those consisting of gravel and bituminous materials incorporated together by penetration methods.
>
> Bituminous concrete pavements are those having a wearing surface composed of stone, gravel, sand, etc., or combinations thereof, and bituminous materials incorporated together by mixing methods.

The definitions of bituminous surfaces and bituminous concrete pavements quoted above have been advocated for adoption in the reports of the special committee on "Bituminous Materials for Road Construction and Standards for Their Test and Use" of the American Society of Civil Engineers, whereas the fundamentals of the above definition of bituminous macadam pavements are embodied in the following quotation from the 1913 Report of the Association for Standardizing Paving Specifications: "If the stone is spread in place and the bituminous cement or binder applied afterwards, the resulting product is bituminous macadam." As sheet asphalt pavements have been in use for many years and as the essentials of good construction have been well established, this type of bituminous pavement will not be dealt with in this paper.

Bituminous Surfaces

Since the formulation of the fundamental principles of the successful construction of tar surfaces by the engineers of the Department of Roads and Bridges of France in 1903, bituminous surfaces have been used extensively in Europe. As an illustration might be cited the construction of five million square yards of tar surfaces in one County of England in 1911, under the supervision of the County Surveyor of Kent, H. P. Maybury, M. Inst. C. E. During the last eight years American engineers have used bituminous materials in this method of construction and maintenance of roads and pavements.

In the case of broken stone and gravel roads, the most efficient method of procedure is to thoroughly clean the surface by sweeping with hand brooms or horse sweepers and hand brooms, the final sweeping being done with bass or other fine fibre brooms. The bituminous material, which is generally heated, is applied to the surface in amounts varying from one-quarter to one-half gallon per square yard, with the aid of pouring cans, hose attached to tanks, hand drawn gravity distributors, horse drawn or motor truck gravity or pressure distributors. Some kind of mineral coating is generally applied to cover the bituminous material. The degree of cleanliness of the surface obtained by sweeping will depend to a large extent upon the details of the original construction. It has been found that a road with a thoroughly rolled and well puddled broken stone wearing surface, composed of road metal from one-inch to two-and-one-half inches in longest dimension, may be easily cleaned and the essential adhesion of the bituminous surface readily secured. This method is characteristic of the modern practice of many of the foremost English and French engineers.

Considerable development has taken place in the use of different kinds of bituminous materials. Tars, both of the water-gas and coal-gas types, continue to be used to a large extent. Without doubt the most comprehensive specifications for the construction of bituminous surfaces with tar are those adopted by the Road Board of England. There has been noted a growing objection to the use of certain asphaltic oils which require from two to three weeks to "set up" to such an extent that tracking will not occur.

Bituminous Macadam and Bituminous Gravel Pavements

Bituminous macadam and bituminous gravel pavements are of many types, one of the primary differences in construction being the use of one or two applications of the bituminous material. The efficacy of many of the types depends upon the combinations of sizes of broken stone or gravel and the combinations of bituminous materials used when two applications are employed. Variations in types also exist dependent upon the manner in which the different courses may be filled and the treatment of the filled course prior to the application of the bituminous material. The one application method is very similar in its simplest form to the construction of a bituminous surface, except that the bituminous material is applied upon a much more open surface. In the case of the two application method in certain instances an attempt is made to build up a two-course pavement, while in others the second application is in reality used as a seal coat.

Two of the main difficulties in the construction of bituminous macadam pavements have been to secure a thoroughly compacted wearing course of non-segregated broken stone and the uniform application of the bituminous cement, so that the broken stones of the wearing surface would be uniformly bound together. In connection with the above statement should be noted the following excerpt from the 1914 Report of the Special Committee of the American Society of Civil Engineers:

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[*] Professor of Highway Engineering in Columbia University, New York City.

> "An important factor for successful results (in the construction of bituminous pavements by the penetration method) is the thorough compaction by rolling of the road metal before the spreading of the bituminous material."

Two methods which have given satisfactory results will be cited as examples of modern practice.

When the metalling in the wearing course consists of a naturally graded aggregate ranging in size from one-half inch to an inch and one-quarter, it has been found unnecessary to further fill the voids by the application of a finer product before the first application of the bituminous material. The character of the product referred to is shown by the following mechanical analysis:

Percentage passing ½-inch screen	18.9
Percentage passing ¾-inch screen	43.1
Percentage passing 1-inch screen	34.4
Percentage passing 1¼-inch screen	3.6
	100.0

After the wearing course has been thoroughly rolled, from one and one-quarter to one and three-quarters gallons to the square yard of bituminous material is uniformly distributed. Stone chips, free from dust, are then distributed to fill the surface voids. After the chips are rolled a seal coat of one-half to one gallon per square yard of bituminous material is applied. The pavement is finished by the rolling of a second application of stone chips.

As the second method will be described what the speaker considers the most satisfactory type of bituminous macadam pavement at present constructed in England. The bituminous pavement referred to is known by the name of "Pitchmac" and was designed by the City Engineer of Liverpool, John A. Brodie, M. Inst. C. E. The following description of the standard method employed in Liverpool is given by Mr. Brodie.

> "Pitch grouted macadam has been found to give most satisfactory results in streets of medium and light traffic, and is now being largely used in place of ordinary macadam, and also of more expensive pavements. It is laid to a depth of from 3½ inches to 4½ inches, in two layers. Welsh granite macadam is used, broken to a 2½-inch gauge for the lower layer and to 1½-inch for the top surface. Each layer is put down dry and continually rolled before and after the grouting of pitch and sand mixture has been applied, until the surface is thoroughly consolidated. The foundation is generally of hand-pitched rock, 10 inches deep as for ordinary macadam, but in some cases a bed of 6-inch concrete has been used on main roads. Pitch macadam is also being much used as a surface covering for old boulder pavements, many of which still exist in Liverpool in old streets where the traffic is very small. The cost of pitch macadam may be taken at 1s. (24 cents) per square yard per inch of depth."

Bituminous Concrete Pavements

Bituminous concrete pavements other than sheet asphalt and pavements laid by companies as proprietary articles have received more attention during the past three years than at any time since the days of Abbot, Leverich, Scrimshaw, and Van Camp. Less fear of litigation proceedings and the introduction of economical mixing machines equipped with heating attachments have exerted a marked influence. But, furthermore, the rapidly growing recognition of the inherent advantages of bituminous pavements constructed by the mixing method has been largely instrumental in its adoption for traffic conditions for which it is believed to be economical and suitable. Bituminous concrete pavements, in which broken stone forms an integral part of the mineral aggregate, may be divided into three classes.

It is self-evident that the simplest type is one having a mineral aggregate composed of one product of a crusher, that is, similar to the product, in the usual type of portable crushing and screening plant, which passes over one screen and through the larger holes of the adjacent screen. This broken stone, in certain cases, may be somewhat uniform in size but usually such is not the case. In the speaker's opinion, an essential element in the construction of this type of bituminous concrete pavement consists in using a product of a crusher which will have a range from an inch to an inch and a quarter in its sizes. As an illustration will be cited a mechanical analysis of a product which was obtained from a plant where the broken stone passed over a one-half inch screen and through a one-and-one-quarter-inch screen.

Percentage passing ⅛-inch screen	1.2
Percentage passing ¼-inch screen	4.2
Percentage passing ½-inch screen	34.7
Percentage passing ¾-inch screen	40.6
Percentage passing 1-inch screen	17.3
Percentage passing 1¼-inch screen	2.0
	100.0

It is apparent that the above product would not be referred to as composed of uniform sized stone. It is of interest to note that certain bituminous concrete pavements, having a width of twenty-five feet, constructed with this product of broken stone in 1911 have been subjected to an average daily mixed traffic of two thousand to three thousand vehicles, and are at present in excellent condition with no maintenance charges to date.

This type of bituminous concrete pavement has been constructed for many years by using either one or, in certain cases, several courses of broken stone mixed with bituminous cement. As an illustration of the latter method will be cited the practice of one large construction company which builds this type of pavement. The first, or bottom course, of metal coated with bituminous cement ranges from one-and-one-quarter inch to two-and-one-half inches; the second course, from one-half inch to one and one-quarter inches; and the third course, from one-quarter inch to one-half inch. The pavement is finished with a dressing of uncoated chips.

Asphalts, tars and tar-asphalt compounds have been used for the bituminous cement. In some cases one kind of bituminous material has been used in the mix and another kind for the seal coat; one of the most common combinations being the use of tar in the mix and asphalt for the seal coat.

As illustrative of some of the details of construction of this type of bituminous concrete pavement which should be covered in contracts, excerpts from specification recently drafted by Mr. Prevost Hubbard and the speaker for the New York State Department of Efficiency and Economy will be cited. It should be borne in mind that the temperatures and other limitations specified apply to the bituminous cements and mineral aggregate covered in other sections of the specifications.

Broken stone for the bituminous concrete shall be heated as directed before [illegible] [illegible] [illegible] [illegible]

[illegible] and 149 deg. C. (300 deg. F.) in revolving driers in which no flame shall be permitted to come in contact with the broken stone and in which the broken stone shall be continually agitated during the heating.

The asphalt cement or refined tar shall be heated in kettles so designed as to admit of even heating of the entire mass, with an efficient and positive control of the heat at all times. Asphalt cement shall be heated as directed to a temperature between 135 deg. C. (275 deg. F.) and 177 deg. C. (350 deg. F.). All asphalt cement heated beyond 177 deg. C. (350 deg. F.), either before or during mixing with the broken stone, shall be rejected. Refined tar shall be heated as directed to a temperature between 93 deg. C. (200 dg. F.) and 135 deg. C. (275 deg. F.). All tar heated beyond 135 deg. C. (275 deg. F.), either before or during mixing with the broken stone, shall be rejected.

"When thoroughly heated to the temperature directed, the asphalt cement or refined tar and the broken stone for the bituminous concrete shall be mixed so that the resulting mixture shall contain between five (5) and seven and one-half (7½) per cent. by weight of bitumen as directed. A mixer shall be used, having revolving blades, and so designed and operated as to produce and discharge a thoroughly coated and uniform mixture of non-segregated broken stone and asphalt cement. When discharged, mixtures of asphalt cement and broken stone shall have a temperature not more than 149 deg. C. (300 deg. F.) and not less than 93 deg. C. (200 deg. F.) as directed. When discharged, mixtures of refined tar and broken stone shall have a temperature not more than 121 deg. C. (250 deg. F.) and not less than 66 deg. C. (150 deg. F.), as directed.

"The bituminous concrete, heated and prepared as specified, shall be delivered direct from the mixer to the point of deposition on the foundation in trucks or wagons, provided with canvas covers for retaining the heat. As delivered the bituminous concrete shall have a temperature of at least 66 deg. C. (150 deg. F.). Material having a lower temperature than this shall not be laid upon the foundation.

"Rollers used on the bituminous concrete and the seal coat shall be well balanced, self-propelled, tandem rollers, weighing between ten (10) and twelve (12) tons each. Each shall have a compression under the rear roller of between two hundred (200) and three hundred and fifty (350) pounds per linear inch of roll, and shall be provided with an ash pan, which shall prevent ashes from dropping onto the bituminous concrete or seal coat.

"As soon as possible after the compaction of the bituminous concrete, when the surface is clean and dry, a seal coat of the hot asphalt cement shall be evenly distributed over the bituminous concrete and spread by means of squeeges as directed. The asphalt cement shall be applied at a temperature not less than 135 deg. C. (275 deg. F.), nor more than 177 deg. C. (350 deg. F.), at a rate of one-half (½) to one (1) gallon per square yard, as directed. A thin, uniform layer of dry, clean, No. 1 broken stone (stone chips) shall be immediately spread over the asphalt cement, as directed, by machines or skilled workmen. The spreading of the No. 1 broken stone shall not lag more than twenty (20) feet behind the placing of the asphalt cement coating. Number 1 broken stone shall not be placed on the wearing course before the asphalt cement of the seal coat is applied. The surface of the bituminous concrete shall be kept scrupulously clean until the seal coat is applied, and the contractor shall not permit any hauling over this wearing course before the completion of the seal coat.

"No bituminous concrete shall be mixed or placed between October 1 and May 15, except by written permission, and no bituminous concrete shall be mixed or placed when the air temperature in the shade is below 10 deg. C. (50 deg. F.), or when the foundation is damp or otherwise unsatisfactory."

The second type usually consists of the broken stone composing one product of a crusher and sand or other fine mineral matter mixed together with a bituminous cement. The wearing surface of this mix is sometimes finished by rolling in fine stone chips but generally a seal coat is used together with fine mineral matter for a top dressing. When constructed on a commercial scale, the mineral aggregate is always heated and mixed in a specially constructed machine. Usually the same grade and type of bituminous material is used for the mix and the seal coat.

In the third type of bituminous concrete pavement the composition of the mineral aggregate is definitely covered in properly drawn specifications. As an example may be cited the following method of covering the composition of the mineral aggregate of Warrenite, a proprietary pavement of the Warren Brothers Company, which was used by William H. Connell, Chief of the Bureau of Highways, in drafting specifications for the City of Philadelphia.

"Material passing 1¼-inch screen and retained on No. 2 sieve, 40 to 60 per cent. Material passing No. 2 sieve and retained on No. 4 sieve 10 to 20 per cent. Material passing No. 4 sieve and retained on No. 10 sieve, 10 to 5 per cent. Material passing No. 10 sieve and retained on No. 30 sieve, 10 to 5 per cent. Material passing No. 80 sieve at least 25 per cent. of which will pass a No. 200 sieve, 10 to 5 per cent. The balance, to pass No. 30 sieve and be retained on No. 80 sieve."

The 1914 Specifications of the State of New Jersey contain the following description of the grading of a bituminous concrete pavement similar to the one given above.

Size of Screen	Percentages Minimum	Maximum
Passing 1½-inch and retained on 1-inch	0	15
Passing 1-inch and retained on ½-inch	40	50
Passing ½-inch and retained on ¼-inch	10	25
Passing ¼-inch and retained on a 10-mesh sieve	8	15
Passing 10 and retained on a 30-mesh sieve ...	12	22
Passing 30 and retained an a 80-mesh sieve ...	5	15
Passing 80 and retained on a 200-mesh sieve ...	3	8
Passing a 200-mesh sieve	2	8
Bitumen Content	6.5	8.5

In the construction of all types of bituminous concrete pavements, in addition to the requirements covering the properties of the bituminous cement and the quality and character of the mineral aggregate, certain essential features should be given careful consideration. The following citations from the 1914 Report of the Special Committee of the American Society of Civil Engineers are especially pertinent:

"Where the character of the traffic justifies the use of a bituminous concrete pavement, the same conditions demand an extraordinarily strong foundation therefor.

"The amount of bituminous material to be used in any case will depend upon the peculiar conditions of that case, such as the kind of road metal and of bituminous material, the character of the aggregate, the climatic conditions, etc.

"The character of the mineral aggregate to be used may be controlled by local conditions, but the best results can only be obtained by the use of the best materials. Excessive sizes, or excessive variations in the size of the mineral particles, should be avoided, and the utmost care must be taken to avoid the segregation of the different size particles.

"Mixing machines should be used, and hand-mixing methods should be avoided wherever practicable.

"In the use of a heated aggregate for the construction of a bituminous concrete pavement non-uniformity or excess in the heating of stone should be avoided.

"Where bituminous pavements are laid, the edges should be protected and a sudden transition from the pavement to any softer shoulder material avoided by means of cement concrete or other edgings and such reinforcement of the shoulder material as may be necessary."

Proper Care of Road Machinery

By A. R. Hirst

ROAD machinery is an expensive investment, but doubly so if care is not exercised in its maintenance. If a few simple and inexpensive precautions are observed, it will result in an annual saving of thousands of dollars to the counties.

In the case of rollers, rock crushers and crusher power, which, during operation, are constantly exposed to dust, a liberal supply of oil or grease should be used to flush all bearings and thus prevent the rapid wear resulting from the presence of grit and foreign matter in dry bearings. Good lubrication of all machinery is the first step toward its economical maintenance.

Keep a good supply of extra parts on hand in case of breakage, especially for rock crushers. An extra link for the elevator chain may save many valuable hours. Extra crusher dies should always be on hand.

A tool box equipped with waterproof cover and fastened with a padlock is a necessity. This box should contain, among other things, a good supply of bolts of assorted sizes and lengths, with washers to match; also rivets, screws, nails and spikes. In brief, keep constantly on hand a generous supply of everything likely to be needed in case of a breakdown.

Insist that the roller operator keep his machine clean and in good repair. All grease and dust should be removed from the machine some time before the close of each day's work. A roller that has the appearance of a piece of junk after a single season's work is evidence of inexcusable neglect.

On the larger jobs, a small portable blacksmith's outfit is very useful. With this equipment, rooter and plow points and small tools can be sharpened as often as may be necessary without the delay incident to sending them to a blacksmith. Dull tools make expensive work.

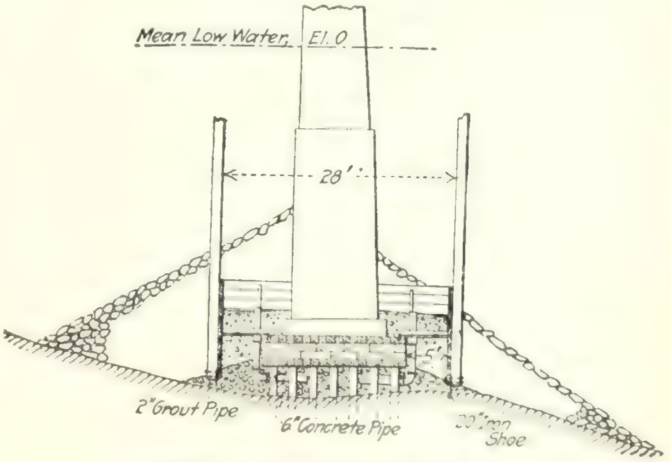
When the season's work is completed, all machinery should be cleaned thoroughly, and a coating of heavy oil applied to all polished surfaces, boiler jackets, shafts, etc., thus preventing rust. Also paint smoke boxes and stacks. Machinery should be stored under cover. It is not necessary that storage sheds have tight sides, but a good roof is essential. It is not the usual practice to keep rock crushers under cover, but if this is done the machine will be in better running order when work is again begun. Rollers, road machines, power engines, wheelers, slips, plows and sprinkling wagons should always be protected during the winter season. Drain all water from all machinery before leaving it.

Sir Thos. Shaughnessy, President of the Canadian Pacific Railway, stated in an interview a few days ago that now was the time for federal and provincial governments to start works of permanent value. Such work would be of much advantage at a time when private corporations were compelled to retrench.

Repairing a Settling Bridge Pier

RATHER an extraordinary case of bridge-pier settlement, which occurred some years ago, has just been reported to the Boston Society of Civil Engineers in a paper read by James W. Rollins, a member of the contracting firm of Holbrook, Cabot & Rollins. The pier in question is Pier 4, the deepest of the pile-footed piers in the Brightman Street bridge at Fall River, Mass., across the Taunton Great River. This bridge is for highway only, has a 50-ft. roadway with two sidewalks of 10 ft. each, and three 200-ft. spans and a rolling-lift span with an opening of 100 ft. Pier 4 is between two 200-ft. spans, each of which weighs approximately 250 tons. It is a prismatic concrete structure 56 ft. high from the top of the pile footing to the top of the concrete masonry.

This pier, in common with two others in the bridge, was founded on timber piles which were driven into and sawed off at the rather hard river bottom, which is from 40 to 45 ft. below water level. The piers were built inside of timber cribs which were sunk to the pile footing by weighting with the masonry which formed the pier. After the pier was completed, the outside forms were removed, but the bottom of the crib, a thickness of 4 ft. in four layers of timber, was left to form a grillage floor between the piles and the masonry.



Repairs to Pier No. 4, Brightman Street Bridge.

The bridge was completed in 1908. About three years later, decided settlement appeared in Pier 4. There was a settlement of about 2 ft. on one side of the pier and a list of 8 to 12 in. away from the side where the greatest settlement occurred. An investigation by divers showed that the broken stone filling which had been placed around the tops of the driven piles had washed out, and that the protruding piles had been broken off all along one side of the pier, allowing the pier to settle. On further investigation, it was found that the piles in this space between the river bottom and the crib had been eaten by the teredo, which is extremely prevalent in the waters of Fall River.

This particular activity of the teredo is, however, most extraordinary, if not unique. The United States Department of Agriculture Forest Service Bulletin, entitled "Preservation of Piling against Marine Wood Borers," says, in respect to the teredo:

> The portion of the pile commonly attacked is between mean low water and a point 4 ft. below, although sometimes it extends downward as far as the pressure of the water will

permit. They seldom work to a depth of over 30 ft., and their worst attack is in very salty, warm clear water.

Mr. Rollins states that the bridge is in Taunton Great River, several miles from the sea and a city sewer discharges into the river within 500 ft. of the bridge, so that the water is not clear nor very salty, yet the teredo works there to a depth of 65 ft. below low water. The particular piles which caused the partial failure of the pier were eaten away at a depth of 15 ft. below low water.

Repairs to the Pier

It was necessary to proceed quite rapidly to the repair because of the condition of the entire bridge. The sinking Pier No. 4 had thrown the spans upon that pier out of line and grade so far as to abut them against the next spans, with the result that a partial arch action was set up clear across the bridge. If the pier had sunk any farther it would probably not only have caused the failure of the spans next adjacent to it but possibly of the entire bridge. For this reason, the span most affected next to the pier was blocked up on a separate pile bent driven under the panel-point next to the pier.

Briefly, the method of repairing the pier was (1) to fill underneath it, that is, in between the protruding piles, with broken stone and gravel shoved in as hard as possible by divers; (2) to construct a framework around the pier with solid board forms about 8 ft. above the broken stone which had been placed under the pier, and to fill within this form with concrete; (3) to grout the stone under the pier and the new crib; and (4) to dump riprap around the pier proper. The methods in detail are described as follows by Mr. Rollins:

> First, 6-in. wrought-iron water pipes 6 ft. long were placed between the crippled piles under the grillage and elbows put on them, with vertical pipes about 8 ft. long fastened to them. A second set of grout pipes 2 in. in diameter were also put in, to make sure that the space between the grillage and the river bed should be made solid. The second operation was to build a form, of 3-in. planks about 8 ft. high, at the bottom of a long timber frame which extended to about 5 ft. above high water. This form was sunk 5 ft. outside the old crib grillage floor, and had an iron plate on the lower edge to provide a seal into the bottom of the river or into the crushed stone which had been placed by divers subsequent to the discovery of the settlement of the pier.
>
> Riprap and crushed stone were then placed outside of this form to steady it and 1:2:3 concrete was deposited through a tremie from the top of the bridge into the space between the grillage and the form. This concrete was made wet to seal the bottom and the crushed stone and was brought up above the top of the grillage all around the pier. This was allowed to set up solid and then a rich concrete, made with 1-in. pebbles, sand and cement, was forced into the 6-in. pipe, but with no success, probably because the concrete deposited outside the grillage under considerable pressure had been forced into all the larger cavities under the grillage. The whole mass was then made solid by forcing grout through the 2-in. pipe until a pressure of 100 lb. per sq. in. would produce no flow.

Finally, a great amount of riprap was deposited all around the pier to a greater height on the weak than on the stronger side. The top of the pier was leveled up, the temporary supporting bent removed and the trusses fixed again on the new pier top.

The work was done under special contract. The total cost without any profit to the contractor, was about $60,000, repair work on Pier 4 alone costing about $25,000.

Compound Piling.—Timber Below, Reinforced Concrete Above, and an Effective Coupling

MANY as are the advantages which attend the use of concrete and reinforced concrete piles, there is a limit to their scope, owing to the circumstance that concrete is attacked by certain kinds of soils and subsoil waters. This is specially the case in marshy or boggy soils, and in subsoil waters containing acids or acid salts, magnesium salts, sulphur compounds or carbonic acid.

Since, then, timber is not attacked in such soils, nor in subsoil waters of the kinds mentioned, and since, in this respect the only proviso is that a timber pile must be permanently under water, we are led to the idea that in such cases where the soil or the subsoil water attacks concrete, we might construct a compound pile with the lower part of timber and the upper part of reinforced concrete.. Intimate as is the association of ideas, we are confronted with the practical difficulty as to how two structural materials so dissimilar as timber and reinforced concrete are to be coupled together in a satisfactory manner. The problem has been solved in an effective and yet simple manner as described herein.

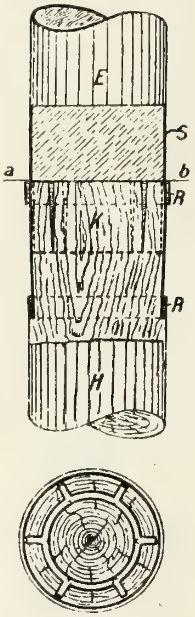


Fig. 1.

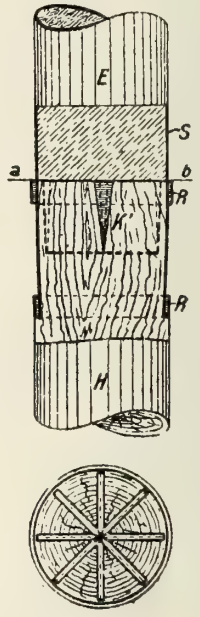


Fig. 2.

The manner in which this compound pile is made is shown in Fig. 1. Before being driven, the timber pile H is made cylindrical at the top, so that a wide binding ring or band can be driven on to it. The timber pile is then driven down until its head is about a metre above the ground or water level. The band is then taken off and a steel tube S, conical in a downward direction, is driven on to the head of the pile by means of a tube head-piece. A ring-wedge, K, is then set upon the head of the pile and is driven into it by means of the ram with suitable dolly. By the driving in of this ring-wedge the originally cylindrical pile-head is forced into the form of a cone, completely filling the conical part of the steel tube, and pressing the pile-head very tightly against the constraint of this shell. When the pile is very hard a conical wedge with radial wedge-ribs may be employed instead of the ring-wedge; and a compound pile constructed in this manner is shown in Figure 2. To avoid the danger of the steel tube changing its shape during the driving in of the ring-wedge, an iron strengthening ring, R, is provided.

By this simple joining of the steel tube and the wooden pile both parts are wedged together, and a tight joint is obtained by the ample pressure between the tube and the wood. When the tube has been made fast on the pile in this manner the pile can be driven into the desired depth by means of a tube head-piece. Then the iron reinforcement is placed inside the tube, and the concrete filled in. The coning of the steel tube may sometimes be omitted, but in this case it must be taken into consideration that the resistance of the cylindrical tube is much less than that of the conical tube, and that a change of shape of the tube at the joint is therefore much more to be feared. For this reason specially stout strengthening rings should be provided. An essential advantage in this method of construction consists in the fact that the pile can be driven with the pile-driver usually employed for timber piles. The costly special pile-drivers necessary for reinforced concrete piles, and the heavy staging necessary in the employment of such pile-drivers are not required. This advantage is specially welcome in the case of pile work in boggy and marshy soils, for in such places the erection of the heavy staging is not only very troublesome, but also involves considerable expense.

A valuable advantage of this compound pile is that it is a very simple matter to place it in position, and that no special precautions need be taken. In the employment of reinforced concrete piles it is necessary to make special arrangements for the assembling of the reinforcement, the setting up of the forms, and the moulding of the piles, for which reason the use of reinforced concrete piling is confined to the larger undertakings. These compound piles will be specially suitable for the carrying out of small works for which, though it is desired to obtain the advantages of reinforced concrete piles, the establishment of a special plant for their erection is avoided on acount of the cost.

The compound pile has a special advantage in sea works. A timber pile standing in sea water will very soon be destroyed by boring shellfish and bore-worms, while, on the other hand, reinforced concrete piles are not seldom attacked by the sea water. By the employment of the compound pile in such a manner that the timber portion is in the ground, and the part which is surrounded by sea water consists of reinforced concrete girt with the iron tube, a very durable pile is provided. The steel tube would, of course, be protected from rusting by a coating or metallic covering, and would be made of a suitable thickness and strength.—The Surveyor.

How to Clean Concrete from a Mixer

Answering this question in the columns of a contemporary, Mr. J. A. McCarty, of Detroit, says it is a better plan to keep the mixer clean, in the following manner:—"One cu. ft. of sharp broken stone should be dumped into the mixer each noon and night, along with clean water. The mixer should run, say 5 minutes, then stone should be dumped out into a box that is equipped with handles, and has plenty of ½-in. holes in the bottom to let the water out. The box can be set aside and the stone wi!l be right there on the job for next cleaning. A mixer that is kept clean will scour very bright in a short time. A brick made of carborundum can be obtained. These bricks easily clean concrete from the sideloader."

Concrete vs. Other Materials for Factories

It is exceedingly difficult to lay down an absolutely definite rule as to the comparative economy of the methods of construction generally adopted for factory buildings. The accompanying figures relate to a case where competitive prices were obtained for a building of fair size and quite suitable to afford a basis for reliab!e comparison. Alternative schemes were prepared in full detail, and competitive prices obtained. Expressed in percentages, the results were as shown in the table.

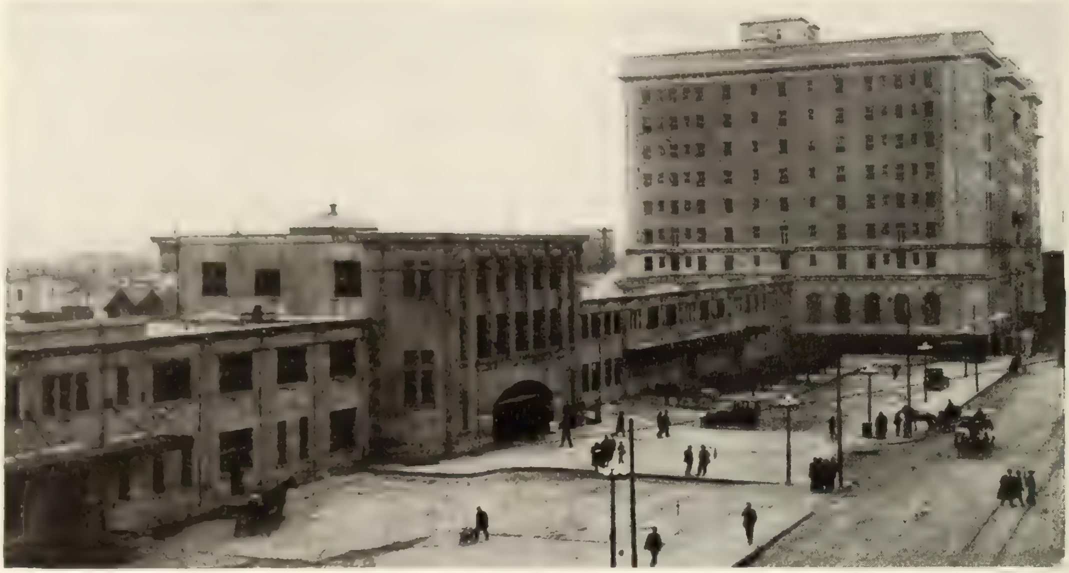
Comparative Costs of Factory Construction

1. Steel frame building with brick walls, corrugated iron roof, wood joists and boards on steel bearers to galleries, and patent roof glazing	100%
2. Reinforced concrete building with roof at last	92%
3. Reinforced concrete building with concrete roof, part flat, part with lantern lights, and with brick panel walls	89%
4. Steel frame building, as No. 1, but with corrugated iron walls	89%
5. Reinforced concrete building (no other structural material used)	88%

It cannot be expected that the comparisons here given will apply to all factory bui!dings. The question of relative cost is affected a good deal by the number of storeys and the size of the structure. In the case of small buildings, reinforced concrete may prove more costly than other materials, although far superior in strength, durability, and freedom from maintenance charges.—Ferro-Concrete.

Field Connections in the Equitable Building

The field connections in the lower seven storeys of the Equitable Building, New York City, are very largely made with 1⅛-in. rivets, of grip up to about 9-in. It has been found that to drive these rivets successfully the largest obtainable pneumatic hammers are required, and air pressures up to 110 lb. must be used. Further, it is important that the point of the rivet be no hotter than the shank under the head, and in some cases the rivets are cooled at the point by dipping into water. In the early stages of the work, a rather heavy percentage of rivets was condemned by the inspector, in some cases because not enough stock had been left for the heading up. As these rivets are now being used, a length of 2⅛-in. is allowed over the grip to form the head and to supply metal for the upset. This allowance is somewhat excessive, but it gives a safe margin to allow for any overrun in the size of hole, etc. Practically all the field-connection holes are reamed out after assembling, in spite of the fact that they are already drilled holes. The reaming insures a perfect match and guards against difficulty in entering the hot rivet. The hammers used are long-stroke Boyer and Ingersoll-Rand 1 13-64 x 8-in. hammers. The experience of the riveting gangs of the Thompson-Starrett Company, as stated by the boss of rivetters, is that about 50 per cent. more ⅞-in. rivets, or about 75 per cent. more ¾-in. rivets could be driven in the time required for a given number of 1⅛-in. rivets. This, as will be seen, means that the 1⅛-in. rivets do not cost more per sq. in. to drive than rivets of smaller size

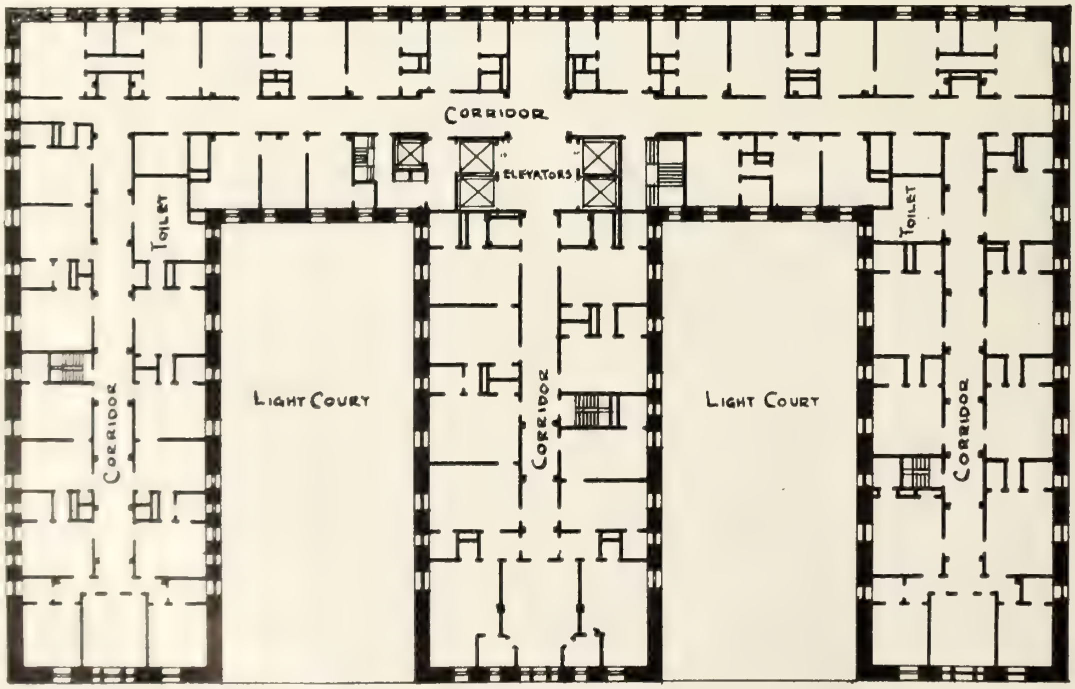


C. P. R. station and hotel at Calgary.

The New C.P.R. Hotel Paliser at Calgary

THE C. P. R. have just added another to their list of hotels stretching across the Dominion. This is known as the Paliser, and is situated at Ninth Avenue, Calgary. The plans were by Messrs. E. & W. S. Maxwell, Montreal, and the contractors were Messrs. P. Lyall & Sons Construction Company, Limited, Montreal, Mr. Sanford N. Mapes having charge for the C. P. R.

The building, the site of which is *227* ft. x 145 ft., has a basement, ground, mezzanine and seven service floors, with a roof garden and sun parlour on the roof. The architectural style of the exterior is French Renaisance. Buff pressed brick, of Roman size, is used for the facing of the walls and Indiana limestone for the trimmings. The frame is of steel with reinforced concrete. In shape the building is rectangular as far as the first floor. Above that it is "E" shaped, contained in one wing, 46 ft. wide by *227* ft. long, on the south side, next the railroad tracks, with three projecting wings at right angles on the north or street side.



C.P.R. hotel, Calgary, typical bedroom floor plan.

These wings are 99 feet long, 46 feet wide for the two end ones, and 54 feet wide for the centre one. There are no "inside" rooms. The spaces between the wings afford provision for skylights for the lighting of the lower floor.

The main entrance is on Ninth Avenue, the entrance hall being 46 x 32 feet. The palm room (42 x 50 ft.) is on the left and the drawing room on the right. Beyond is the rotunda, 147 ft. long by 40 ft. wide. The floor of the rotunda, vestibule, entrance hall and elevator hall is of grey Tennessee marble, and the columns supporting the roof are finished in Botticino marble, with Sylvian marble for the bases. On the right of the rotunda is the main dining-room, 38 ft. wide and 142 ft. long, running the whole depth of the ground floor from north to south and finishing in a semi-circular bay at the south end. On the left of the rotunda there are the flower stand, bar and cafe. The bar and the cafe are each 41 x 56 feet. The floors are of 6 x 4 heather brown tiles and the mantel tiles in the cafe are lined with selected Scotch stones. To the north of the rotunda are the elevator hall and kitchen (137 x 41 ft.). Three passenger elevators, one freight, one help, and two electric dumb waiters are provided.

A view of the new C.P.R. hotel at Calgary which illustrates the advantage of the E shape by which inside rooms are avoided.

The basement, which is reached by stairway from the main entrance, contains the barber shop, baggage room, laundry-receiving room, ten sample rooms, machinery rooms, recreation and sitting rooms for help, bakery, butchery and refrigeration plant. The manager's office, dining-room for officers and help, and musicians' gallery are situated on the mezzanine floor.

The first floor contains a ball room, 48 ft. by 58 ft., situated at the north end of the centre wing. At either side of the ball room, in courts, are pergolas, extending to the side wings. The remainder of this floor, and the whole of the floors above, is occupied by bedrooms, with an average of about fifty to the floor.

The bedrooms range in size from 12 x 15 feet to 20 x 14 feet and are usually in pairs, with connecting doors between and bathrooms on either side. Inside each wing is a broad corridor running down the centre. The bedrooms on the outside of the wings are finished in pale green tints and cream enamel, and those on the inside of the wings in buff and cream enamel. Every bedroom is finished with mahogany doors and a full length of heavy plate glass mirror on the bedroom side of the door. The furniture of the bedroom is fumed oak, with dull brass fittings. There are hot and cold running water, ice water service, telephone, and portable reading lamp, in every bedroom.

The bathrooms are finished in white tile, with ceramic floors and built-in porcelain baths. On every floor is a service room connecting with the kitchen by an electric dumb waiter. Altogether there are 315 guests' bedrooms and 278 bathrooms. The eastern portion of the seventh floor is reserved for help bedrooms.

The heating system in use throughout is direct steam heating with the principal rooms under a system of temperature regulation. Ventilation is secured by large fans drawing in the air through air-filters and washers, and cleaning it of all impurities before being forced into the various rooms through registers at the ceiling. The entire basement and ground floor, with the exception of the dining room, are taken care of by one air-washer, with a capacity of 30,000 cubic feet of fresh air. The dining room has a separate air-washer with a capacity of 25,000 cubic feet. Additional fans are used to draw the air from the rooms and to cause circulation. A refrigerating plant in the basement consists of two ammonia compressors with a capacity of two tons of ice per day.

From the laundry-receiving room in the basement, a tunnel leads to the power house on the south side of the track, on Tenth Avenue—a distance of 490 feet—along which hand trucks with laundry will be conveyed. The power house contains five boilers, which supply the steam heating and power required for the hotel.

The lighting on the street sidewalk is the combination trolley-pole and five-cluster standard. An ornamental iron rail runs the full length of the ground area.

The College of Engineering of the University of Wisconsin are making tests with the object of finding simple means of making concrete watertight. Some of the results obtained so far relate to the effect of the length of time of mixing, and the effects of dry and wet sand, respectively. It has been found that good results are obtained if the concrete remains in the mixer from two to three minutes when dry materials are employed, and that where the sand and gravel or stone are damp a considerably longer time is required. Other experiments showed that mixtures consisting of 1 part of cement, 1½ parts of sand, and 3 parts of gravel, when mixed to a wet consistency, are impervious to water when subjected to a pressure of 40 pounds per square inch. Mixtures as poor as 1 part of cement to 6 parts of well graded sand and gravel have been made impervious at high pressures by using care in proportioning the amount of water and in mixing. The importance of these experiments will be better appreciated when it is remembered that the quality of concrete is dependent largely on the nature and grading of the sand and aggregate.

A Toronto contractor, whose name need not be mentioned, forgot to figure in an item of $710 for labor in making up his tender for the Orde Street school. Consequently his figures were far below those of the next bidder. His application to the Board of Education for the return of his deposit cheque was refused. An expensive oversight!

The Design of Steel and Reinforced Concrete Pillars

FOLLOWING is a summary of a paper read before the London Concrete Institute at the fortieth ordinary general meeting on April 16, 1914, by Mr. Oscar Faber, B.Sc., Assoc. M. Inst. C. E., entitled "The Design of Steel and Reinforced Concrete Pillars, with Special Reference to Secondary and Accidental Stress."

Mr. Faber divided his paper into two sections. He first dealt with jointed construction, such as structural steel, and secondly with monolithic construction, such as reinforced concrete. He first dealt with the case of a girder resting on the end of a steel stanchion and stated that in several drawing offices he knew as a fact that the construction in such a case would be treated as centrally loaded. He proceeded to argue that such was not the case, because when a load was applied to the beam it would deflect and the end originally horizontal would assume a certain slope and therefore one of two things would happen, namely: (a) The end of the girder would lift, in which case the whole load would be carried on one flange, so causing eccentric loading, or, (b) The column must be constrained to adapt itself to the slope of the girder, in which case a bending moment would be introduced into the stanchion by such constraint.

In this way he showed that increases in strains of 140 and 480 per cent. respectively were obtainable.

Mr. Faber took secondly for consideration the case of a girder resting on an angle bracket. He argued that if an ordinary bracket were used the action would not be very far from the face of the leg of the angle, since the horizontal leg of the angle would not be strong enough to resist the bending moment which would be produced in it. It followed therefore that although the horizontal leg of the angle served a useful purpose in connecting the girder to the stanchion, it must not be thought capable of supporting it. In effect the construction became dangerous if the clearing between the face of the stanchion and the edge of the girder exceeded the thickness of the angle.

The author of the paper supposed there were few engineers present who would assert that this limiting clearance was never exceeded in practice, and an engineer had to carefully consider whether it was desirable to employ this type of bracket except for quite small reactions. He next considered a stiffened bracket.

Confining attention to cases where the workmanship was good, he assumed that the stiffening angles had been machined or forged to fit the angle bracket perfectly and that the bracket was initially horizontal. It followed that when the girder deflected there was a tendency for it to rest on the outer edge of the bracket, and for very small loads there was no doubt that this actually happened. As the load increased the outer edge of the stiffeners yielded appreciably, and a greater area supported the load, the reaction gradually approaching the face of the column. The author's practice was to make the web of the stiffeners sufficient in area to carry the reaction under a uniform stress of 7½ tons /in².

In calculating the resistance he ignored a large area of steel in the flange of the stiffeners, and in the vertical leg of the angle bracket because,

(a) The clearance between the face of the stanchion and the end of the girder might be sufficient to prevent bearing on this steel;

(b) Even if it was not, this material could not be stressed appreciably until the stiffener webs are greatly overstressed.

In any case the difference in cost between good and bad brackets was an extremely small percentage of the cost of the steelwork, and a smaller one of the cost of the building, and he declined to endanger the "ship" for what in this case might be fairly described as a "ha'porth of tar."

It has long been recognized in good practice that the machining of the ends of stanchions was of the first importance. Yet there were at least two constructional works in London which, with a view to economy, omitted this item of workmanship, and were erecting considerable tonnages of stanchions with the ends left so that the upper tier had contact with the lower tier over the width of one plate only, the remainder of the section having varying clearances often amounting to ⅛ in. The stress was still gaily calculated as uniformly distributed, and it had been explained to the author that "steel is a ductile material which would yield and flow" and perform other convenient antics, "until the stress was uniformly distributed." The effect of loading such a stanchion was to cause the plates to slide past one another, and to partly shear through the rivets. Even where stanchions are machined a careful engineer must bear in mind also that apart from the danger involved in these practices, the yielding of stanchions and brackets before they obtain their bearing involved unknown and unintended stresses on the stonework, and to the author's knowledge many a beautiful and costly facade and interior decorative work had been badly cracked by bad steelwork details and workmanship.

From the consideration of Case I, it would appear to follow that it was desirable to make these joints somewhat flexible, and occasionally this was so. If buildings were braced with diagonal braces he should say without question that stiffness of connections should be avoided. Unfortunately, such bracing had obvious objections, and the whole stiffness of practical buildings against wind lay in the stiffness between beams and stanchions. There was, therefore, no alternative, but to make the joints stiff and to make the necessary allowance for these secondary stresses in the design of stanchions. This might be onerous, both in requiring extra labor and an increase in material, but a conscientious engineer would grudge neither the one or the other.

Mr. Faber then dealt with the design on cleats. A common method of calculating the safe reaction of a cleat was to take it as the sum of the resistances of the rivets, the effect being to neglect the very appreciable stresses due to bending.

Dealing with the bracing of pillars, Mr. Faber said that it was well known that pillars failed by buckling and that their stress was to be determined with reference to their 1/g. This phenamenon was fairly well understood and there are sufficient experimental data available to make the design of pillars, with reference to what he might call primary buckling a comparatively simple matter. The phenomenon to which he referred was that of secondary buckling, in which the pillar instead of buckling as a whole, fails by the individual buckling of its component members. On this subject there appeared to be practically no experimental data and practically no formulae or rules for the guidance of a designer. The importance of this problem might be gathered from the fact that bad design in the matter of bracing in pillars was certainly responsible for the two greatest failures in recent years—the Quebec bridge of 1907 and the gas holder in Hamburg.

Mr. Faber then proceeded to the second portion of his paper treating of monolithic construction and the eccentricity of beam reactions on pillars therein. Whereas in steel construction the eccentricity was very definite and easily calculated with most common types of brackets, with reinforced concrete the eccentricity could only be calculated from considerations of elastic flexure, and the problem was a much more difficult one. There was, however, no longer any excuse for claiming ambiguity, since the problem had been analyzed very completely in "Reinforced Concrete Design" and numerical examples fully worked out.

The author took as an example the case of the outside column of the building, working it out in detail, showing very great increases in stress over the values as ordinarily calculated. If thoughts of eccentricity were banished either from ignorance or under stress of competition, the actual maximum stress would have been 1,300 lb. /in^2. It is interesting to note that the outside pillar in good design did not suffer much reduction in size up through the last three tiers. This was in accordance with the best practice in steel-frame buildings.

In conclusion, Mr. Faber said that without suggesting for a moment that the engineering staffs of several constructional firms were not fully as efficient as many consulting engineers, he did feel that the system of competitive designs and lump prices penalized good designing by such firms, and secured the work to those responsible for the most risky design. The only correct system, in his opinion, was for the architect to entrust the design to an engineer who had his confidence and to invite tenders on the design which he prepared. The architect and building owner were then likely to obtain a sound construction, and if they used their discretion in the choice of the engineer the work would not cost more than the minimum consistent with safety.

The best constructional firms would be protected by being protected from competition with weak design and bad workmanship, and he might state that in considering tenders, he considered that an engineer should give preference to those firms whose detailing and workmanship he knew he could rely upon. He urged this in the interest of the building owner, knowing as he did the importance of good details and good workmanship. The only man to suffer was the man who would take great risks and do shoddier work in order to secure a contract, and he could not say that he had much sympathy with him.

Frost Resistance of Building Stone

THE most reliable sources whence practical results of resistance have been obtained are the signs of weathering in stones under actual building conditions. Where and when circumstances permit, it is best to submit the stone that is to be tested for several years to all the influences of weathering and then decide on the strength of the extent of exfoliation, cracks and rifts exhibited.

The methods of saturating a little cube with a solution of glauber salz and then freezing it is all very well in theory, but in practice there are several objections. In the first instance, the resistance which stone offers to the solution is very different to that offered to water. It is well known that water when freezing expands, and exerts an enormous pressure. Now, through the addition of the glauber salz this very tendency of the water is obviated and in fact reversed, for salt of any kind is conducive to contraction.

Water therefore remains the only reliable means for testing the resistance of stone, but the cubes must not be entirely covered by water, as in that case the air contained in them has no means of escape; they must be slowly immersed, so that the air can gradually escape as it is being replaced by water.

The water is warmed to a temperature of 16 to 20 deg. C. and to ascertain the maximum saturation coefficient of the sample, is weighed before and after saturation. If finally after repeated weighing, the weight remains the same, it is assumed that the maximum point of saturation has been reached.

The samples so saturated are frozen for 5 hours in a temperature of 12 to 15 deg. C., and then thawed again in distilled water under a temperature of + 15 deg. C. This is repeated from 20 to 30 times. To obtain the necessary cold broken ice and freezing salt is used and the samples are then, without being dried, submitted to pressure in order to ascertain their crushing strength when frozen, which is compared with the stone when not frozen serves a basis for the resistance offered by calculating the relative frost resistance.

The lower the difference of the crushing strength before and after freezing, the smaller the exfoliation and the cracks, the greater the frost resistance. At first sight it seems plausible enough, that the frost resistance should increase correspondingly with the decrease in capacity of absorption, and that frost resistance is in an inverse ratio to the porosity of the stone.

Practical experience, however, proves the opposite. Soft and porous stone is held to be particularly frost-resisting, and hard and brittle stone with few and small pores of but small resistance. The reason, of course, is that with the softer stones the pores give way to the freezing pressure more easily, whereas in the harder ones the constant compact resistance offered conduces to exfoliage, cracks and rifts. The knowledge of the mineralogical components of a stone helps us to ascertain its weather-resisting qualities.

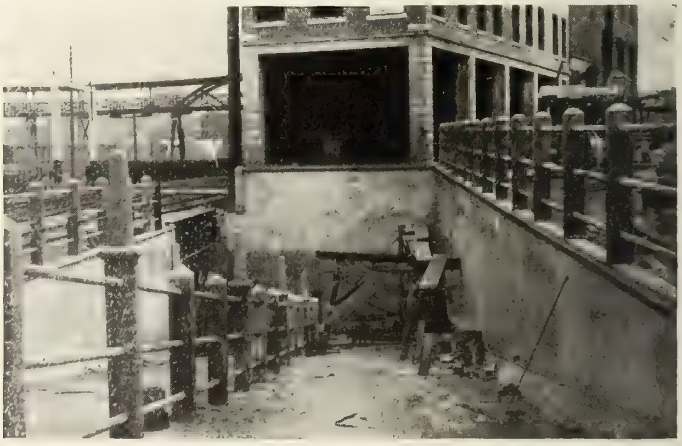
Very harmful additions are principally carbonate of lime, pyrites of iron and gypsum, and most desirable are consequently the most silicious stones.

The great importance attaching to whether or not there is any addition to the water is shown by the fact that basalt, under the influence of water loses 2 per cent. of its dry crushing strength whilst granite loses 8 per cent. It is proved that stone showing a high frost resistance, will also endure against water, but naturally, it must not be assumed that the addition of salt and other materials is superfluous, nor must we overlook the necessity of experimenting with the inclusion of various materials of different stone and their composition. The different methods of testing should not replace, but supplement and complete each other.—Stone Trades Journal.

Subway Construction at Vancouver

CONSTRUCTIONAL operations have just been completed at Vancouver in connection with the new pedestrian subway under the Canadian Pacific Railway tracks leading from Alexander Street to the North Vancouver Ferry wharf. The necessity of providing a subway at this point owing to the congestion of pedestrian traffic was first brought to the attention of the Railway Commission in 1910, but it was not until July, 1913, that the detailed plans of the work were finally approved by the engineer of the Commission and the various parties interested therein. The Vancouver civic authorities then proceeded to call for tenders and in due time a contract was awarded to the M. P. Cotton Company, a local firm which later went into liquidation but eventually became re-organized under the title of the Cotton Construction Company, this concern undertaking to handle the various contracts possessed by the former company. The tenders submitted for the work ranged all the way from $30,000 to $50,000, the estimate of the M. P. Cotton Company being the lowest. Actual construction was inaugurated during the latter half of January, 1914, the time consumed until the completion of the work being a little over four months.

Type of construction beneath C.P.R. railway tracks.



South ramp, looking east.

The southerly approach to the subway from Alexander Street extends downward on a 14 per cent. grade and the same grade is observed on ascending to the ferry landing, nine feet of clear headway being provided in the level stretch immediately underneath the Canadian Pacific Railway tracks. Special provision has been made for the hydraulic pressure under the subway floor due to the rise of tide, a head of ten feet being provided for in the design. The floor and walls are constructed strongly enough to withstand this height of water, which, of course, varies according to the rise and fall of the tide. The north and south ramps, about 80 feet in length and 25 feet wide between walls, are of reinforced concrete the floor being of the same construction. The subway proper is approximately 60 feet long and 25 feet wide between walls. The construction of the portion under the Canadian Pacific Railway tracks is in accordance with that company's standard bridge construction and consists of solid concrete abutment walls with roof of rolled steel joints, 20 inches deep and spaced about 15 inches on centres. Rivetted to the top of the steel beams is a ½-inch ballast plate and on top of the ballast plate are three inches of waterproofing asphalt, with nine inches of ballast above that for the railroad ties.

Provision has been made for dealing with any water draining into the subway by the installation of an automatically-operated electric pump with a capacity of 160 gallons a minute and a sump placed at the southwest corner of the north ramp. The water is carried into this sump by means of galvanized iron pipes embedded in the concrete floors which lead from the catch basins to the sump. The pump is of the ordinary automatic electric type with a float which throws the motor into operation by closing the switch when the water rises above a certain height.

During the construction of the subway, the contractors had very little difficulty in coping with the tides. A row of sheet piles were driven at the north end of the works and successfully held back the water during the period of operations below high tide, the tides being favorable at the time this work was under way.

The task of supporting the railway tracks during the construction of the subway was undertaken by the Canadian Pacific Railway engineers and consisted of simply driving four bents of wooden piles between the tracks, capping these and then placing 8 x 18-inch longitudinal timbers beneath the tracks. The penetration of these piles was very small and it was therefore considered necessary, after excavating to a depth of about 10 feet, to substitute 12 x 12-inch mud sills and 12 x 12-inch posts in place of the piles.

The sequence observed during the progress of construction, following excavating operations, consisted of the erection of the reinforced concrete walls on the north and south ramps, the pouring of the southern abutment walls, and the placing of the floors and the two ramps. The floors vary in thickness from 6 inches at the top of the ramps to 20 inches at the base. The extra thickness at the base of the ramps is accounted for by the pressure which has to be sustained on account of tidewater. When the north ramps and abutments had been completed, the steel portion of the subway was proceeded with, the false work removed from underneath the railway tracks and the floor between the abutments poured.

The New St. Charles Hotel, Toronto

Amongst Toronto's many commodious hotels not the least important from the architectural standpoint will be the new St. Charles Hotel now in course of erection on a site on the north-east corner of Bay and Richmond streets, Toronto. The structure, which will be three storeys and basement, has a frontage of 64 feet on Richmond street by 104 feet on Bay street. It will be of steel frame construction, white matt glazed terra cotta being used for the street elevations. The structure, however, will not be of recognized fireproof construction. The three corners of the hotel will be rounded at a 9-foot radius, and entrances will be placed at each corner, access to the building being through revolving doors.

The design of this new hotel has been an effort to obtain as much window space as possible without interfering with the architectural design. The interior will contain the hotel, office and lobby, a large bar and lunch room, with lavatories adjacent. Provision is made for five storeys on the Bay street frontage. On the first floor will be a large dining room, 40 ft. x 60 ft., and three smaller dining rooms together with kitchen and pantry accommodation. The upper floors contain bed rooms, each of which is provided with modern sanitary appliances. The ground floor will be finished in red tile and staff decorations, while the dining-rooms will have oak floors and similar decorations for the walls and ceilings. The building will be steam heated, electrically lighted, and replete with up-to-date hotel equipment. The architect having charge of the work is Mr. J. P. Hynes, Toronto. Thomson Bros., Toronto, are the contractors for excavation, masonry work, etc. The steel construction, a portion of which has already been erected, is being carried out by the firm of Reid & Brown, Toronto. The building will cost about $65,000.

Experimental Pavement of Small Wood Blocks

LAST fall a strip of 100 ft. of experimental paving was put down on one of the residential streets of Tacoma, Wash., using creosoted wood blocks only, 1⅞-in. wide, 2 in. deep and 3⅞ in. long. All blocks were surfaced on one side and one edge to these dimensions, and are of Douglas fir. The blocks were treated in retorts with approximately 18 lb. per cu. ft. of creosote oil. It is in the treatment that the chief advantage is claimed for the small blocks, for excellent penetration without excessive treatment and a uniformity of grain are obtained more easily than with blocks of standard size.

The blocks were laid on a concrete base, 14½ ft. wide, and were laid without an expansion joint of any kind. The pavement was divided into four sections each 25 ft. long, as follows:

(1) Blocks laid with long axis at right angles to the line of traffic on a 1-in. sand cushion; broken joints, blocks rammed tight.

(2) Blocks laid at an angle of 67½ deg. to line of traffic on a 1-in. sand cushion, rammed tight and joints broken as in Section 1.

(3) Blocks laid on a 1-in. cushion made of one part of cement to three parts of fine sand mixed and spread dry; blocks have long axis parallel to the curb, making unbroken joints along the line of traffic; at right angles to the curb joints are broken.

(4) Blocks laid in the same manner as in Section 3, except bedded in a one part cement to three parts sand grout mixed wet enough to take a smooth trowel finish.

An inspection of the pavement some months after it was laid showed water oozing out between the blocks of Section 4, when the blocks were stepped on. The blocks were not perfectly bedded on the grout for there was a perceptible movement of the surface. The other sections were in excellent condition.

The blocks were furnished and laid by the creosoting department of the St. Paul & Tacoma Lumber Company, on their application for permission to do so as a part of an asphalt-paving contract which was under construction. The lumber company gave the city of Tacoma an agreement to replace the blocks with asphalt when so ordered.

Proposed Industrial Building, Calgary

THE city of Calgary proposes to erect a large reinforced concrete building for the housing of new and small industries. This will be the first municipally-owned power building on the continent. Plans have been prepared in the office of the City Engineer, under Mr. H. A. Sylvester, Superintendent of the Department of Buildings. The by-law for the building, which involves the expenditure of $250,000, has been passed by the ratepayers, and the money is available for erection, the site having been selected and the excavation completed.

Sketch of Calgary's proposed Industrial Building

The plans show a structure with a frontage of 100 feet, the full depth of the lots, and seven storeys high above the basement. The construction throughout will be of reinforced concrete and the building will be provided with every facility necessary for the economic conduct of small industries, besides excellent fire protection and power service. The ground floor will be some 3 ft. 8 in. above the sidewalk grade, and will be mainly given over to entrance facilities and to the freight platforms for the receipt and delivery of goods. A spur track will run into the building next the lane, the storeys above being continued over to gain the additional floor space. The balance of the plot of ground not covered by the building will be utilized for a portion of the freight platform, allowing a team concourse for local deliveries. There will be a total of over 85,000 square feet net in the building for occual or about 80 per cent. of the gross area, a rather high percentage for a building of this type, where heating plant, elevators, and stairways must be provided generously.

Design and Equipment

A unique feature of the building is the planning of the elevators and toilets, allowing a sub-division of each floor, so that four tenants can have direct access to elevators and toilets without the use of any corridors, and without passing through another tenant's space. There will be two freight elevators of 3,000 lb. capacity, with automatic closing doors, controlled by push-buttons; and one passenger elevator with 6 ft. by 6 ft. 6 in. car. The use of the push-button control for the freight elevators is believed to be unique, in that this control has not before been applied to freight elevators. The platforms for the freight elevators will be 8 ft. by 8 ft. 6 in. On each floor there will be at least four power outlets, besides ample outlets for electric lights. There will be no partitions installed at present except those about the elevator and stairway enclosure, it being planned to use solid steel sash with metal and glazed panels to allow of perfect flexibility and maximum salvage, the partitions being fastened to inserts at top and bottom. In addition to the stairway in the elevator enclosure, there will be two fire-escapes at the opposite corners, one of them being carried down inside the walls, enclosed in a steel sash partition, with wired glass. A complete automatic sprinkler system, with two supplies, will be installed, this necessitating the construction, on the roof columns, of a 20,000-gallon tank. The exterior will be finished in the concrete as it comes from the forms, the only treatment of the surface being rubbing with carborundum blocks. There will be practically 60 per cent. glazed area on the exterior walls, allowing for maximum light and air. The steam heating plant will be a vacuum system, requiring three large boilers of 5,000 sq. ft. radiation each, of the return tubular type, to be fired by natural gas. In addition to the ample toilet facilities required by the local ordinances, drinking fountains will be placed on each floor in the lobby in front of the elevators.

The estimated cost of the building complete is $190,000. As far as can be told at present, the floor space will have to be rented at from 28 cents to 33 cents per square foot net. Power will be supplied from the municipal plant for from 2 cents to 0.9 cents a kw. hour, according to the amount to be taken. Electric light will be sold for 7 cents a kw. hour. There will be about 10,000 square feet net rental area on each floor.

Great Tunnel Project

The North River Bridge and Tunnel Project in New York City is now proposed to be financed by bonding the New Jersey counties adjacent to New York for part of the cost of the structure. The recent New Jersey Legislature passed a law providing for the appointment by New Jersey of a new State Commission, with power to make final preparations and go ahead with construction. A commission is to be appointed by the Governor as soon as at least three of the five counties agree to pay for preliminary expenses up to $10,000 each. The estimated cost of a Hudson River Bridge at 57th Street is $42,000,000, and the cost of two tunnels under the Hudson opposite Canal Street, New York City, at about $11,000,000.

Methodist Book and Publishing House, Toronto

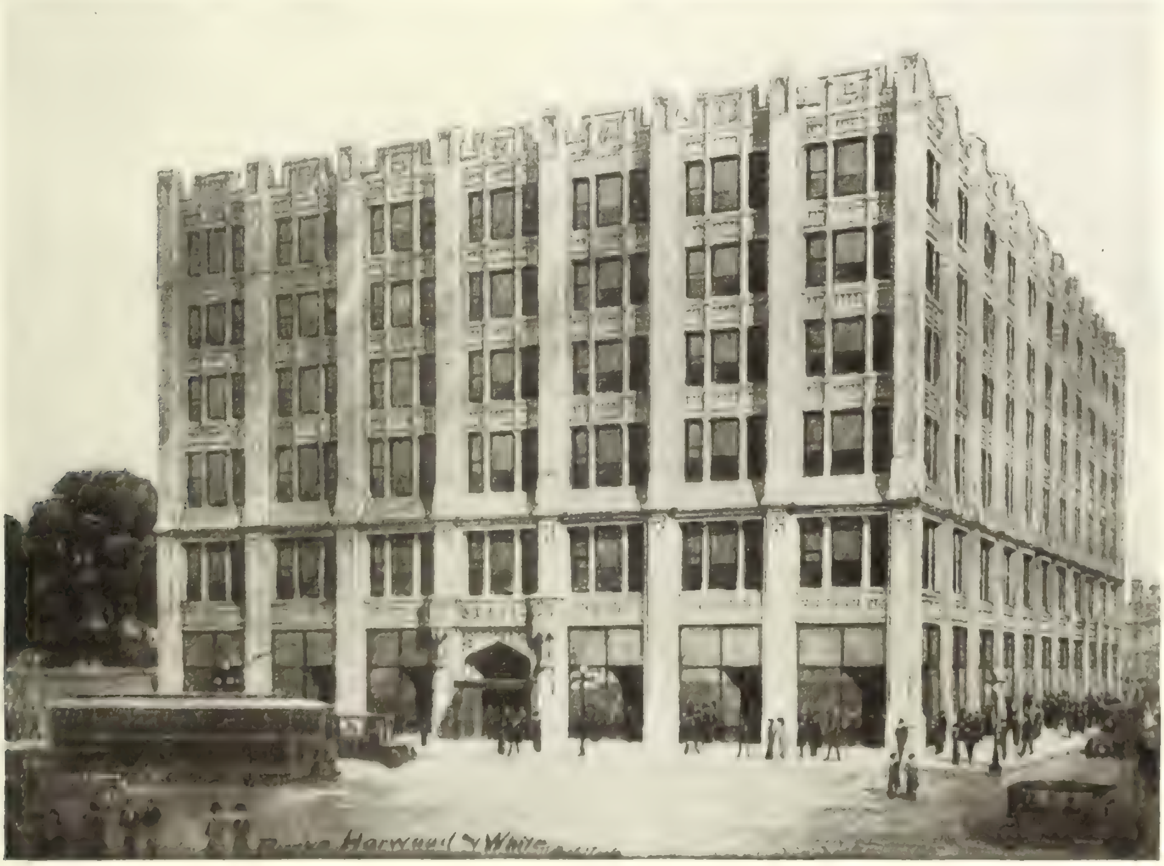
THE new Book and Publishing House which is being erected at Toronto for the Methodist denomination at a cost of about $700,000, possesses several features of interest as regards both design and construction. The site of this new building, on Queen, John and Richmond streets, has been excavated for the main basement, and a steam shovel of the Marion type has been employed in excavating the sub-basement under a portion of the site for the power plant. The floor of this sub-basement will be some 24 ft. below the level of the sidewalk. The building will cover a frontage on Queen street of 135 ft., on John street of 220 ft., and on Richmond street of 190 ft. The structure is planned for an ultimate height of ten storeys and the foundations have been proportioned accordingly. For the present, however, the office portion of the building, with basement, will be five storeys in height and a portion of the manufacturing section on Richmond street will be of two storeys and basement.

The building will be of steel frame construction, the columns resting on concrete caissons or piers, ranging from 5 ft. to 9 ft. in diameter. These caissons are carried down to an average depth of 40 ft. below the level of the street, through blue clay and quicksand to rock. They are proportioned to carry loads ranging from 98 to 159 tons, or a load to each square foot of 25 tons. The floors in the manufacturing section will be of reinforced concrete capable of carrying heavy presses or a load equal to 400 lbs. to the square foot. The floors in the office portion of the structure will be of hollow tile surfaced with terrazzo in the halls, etc., and the office floors will be of hardwood. The entrance to the main office will be finished in marble and mosaic tile. The three fronts will be faced with matt glazed terra cotta of Gothic design, boldly panelled and moulded. This will rest on a granite base 4 ft. in height. The building will be fireproofed throughout and sub-divided into sections with automatic fire doors. Provision is made for seven elevators, the three passenger elevators being high speed.

Methodist Book Room, Toronto.—Filling a caisson with concrete. There are 108 caissons, each averaging 40 feet in depth.

Every provision will be made for handling the work in the mechanical department in the most modern manner and the employees will be furnished with commodious and up-to-date toilet and rest rooms, the sanitary appliances being of the most modern type. The basement will contain large receiving and paper storage rooms, locker rooms and machine and carpenters' shop.

The sectional divisions of the building are classified as follows: the first or main floor will be occupied on the Queen street frontage by five stores and the main office entrance; on the John street side will be stock, entry and shipping rooms, and on the Richmond street frontage the press room, 96 ft. by 188 ft. On the second floor a bindery department will occupy the same area as the press room below, while the rest of the flat will be given over to the wholesale department. On the third floor the Queen street frontage will be occupied by general and private offices and also by a women's lunch room. The central section of this floor will be devoted to the library, stock room and private and departmental offices, while the south section will be occupied by the job printing, proofreaders' and stereotype rooms. The fourth floor is set apart as a boardroom, offices, lunch and rest room, and the linotype department. The fifth floor will be sub-divided mainly for the purpose of rental.



Methodist Book Room, Toronto. Architects' perspective

The building was designed by Messrs. Burke, Horwood & White, architects, Toronto. The John H. Parker Canadian, Limited, Toronto, are the general contractors, the steel work being carried out by the firm of McGregor & McIntyre, Toronto.

The Pittsburgh & Lake Erie Railroad in some new bridge construction at Youngstown, O., specified that no shop paint or oil should be put on. The first paint is applied after erection, scraping the steel clean before painting. The object is to allow the mill scale to loosen by rusting, and thus get the paint applied on the steel itself.

Interesting Construction

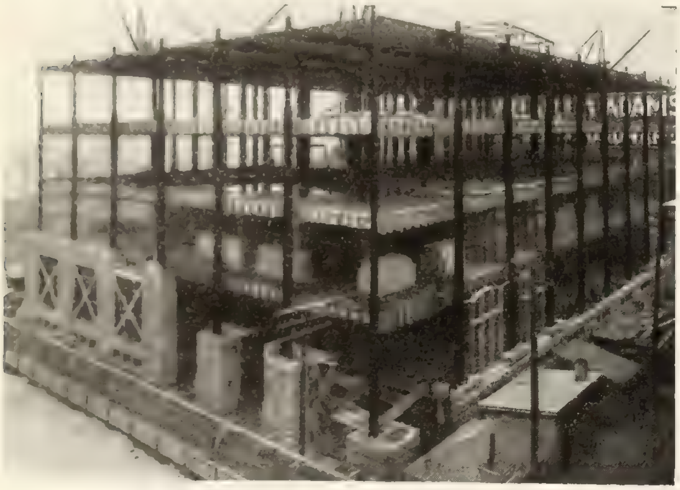
The removal of the two large two-boom timber derrick towers used for erecting the steelwork of the Kingsbridge Armory constitutes quite a task. All the heavy steelwork has been erected so that the big travellers are no longer required. Each is 91 ft. high, 60 x 60 ft. in plan, and is equipped with two separately operated derricks. The framing is all 12 x 12-in. timbers, except the front 14 x 14-in. corner posts, which carry the derricks. In dismantling a traveller one of the derricks on the top lowered the other to the ground. A jinnyswitch was then installed in its place and lowered the second derrick. A ginpole was set on the lower chords of the last two arch trusses and proceeded to take down the framing. When low enough, the traveller was pulled under the trusses to which blocks and talls were fastened. The work then went forward rapidly.

In order to make the Suez Canal of sufficient depth to carry the largest ships afloat, work is now in progress toward deepening the canal to 40 ft. throughout its length, says the Engineering News. When the canal was opened in 1869 the width was 72 ft. and the depth about 26 ft. 2 in. The maximum permissible draft of ships using the canal in 1870 was 24.4 ft. In 1890 ships drawing 25.4 ft. were allowed and during the succeeding 24 years the increase has been at the average rate of about one foot every six years, thus bringing the maximum draft now up to 29 ft. In June, 1913, the depth of 32 ft. 8 in. had been increased over a minimum width of 147 ft. 6 in. for a length of 20 miles. Under the latest scheme, a depth of 40 ft. throughout is to be made and a widening up to 197 ft. in the south section and the cutting of [illegible] sidings on the north and central sections where a minimum width of 147 ft. 6 in. is believed to be sufficient. The company has power to raise bonds up to $30,000,000 for this work, which it is expected will be completed by 1919.

Government Examining Warehouse, Calgary

THERE is at present being built at Calgary for the Dominion Government a four-storey building for use as an Examining Warehouse by the Customs Department. The dimensions of the building are 200 by 112 ft., with a frontage of 200 ft. on Eleventh Avenue. The building is of heavy skeleton steel frame construction with reinforced concrete floors and self-supporting walls.

The foundations are carried down far enough to give necessary depth for the basement. The columns rest on steel grillages. The centre grillages consist in the main of seven 15-in. I-beams 8 ft. 6 in. long with four 20-in. I's resting on top of them, and carrying the column directly on top. The wall column grillages are somewhat larger but all varied according to the loads on them. These grillage beams are filled in and grouted with 1:2:4 concrete thoroughly packed in to fill voids and after packing are thoroughly grouted with one to one cement mortar. Owing to the peculiarity of the subsoil, which exists more or less over all the lower lying parts of Calgary, difficulty was experienced with water. When the foundations got below the river bed level, the porous gravel subsoil allowing the easy passage of water, the holes filled up, and pumps run by electricity had to be kept going most of the time to keep the water under control, as the excavation for the grillages, which were below the river level, would fill up over night.

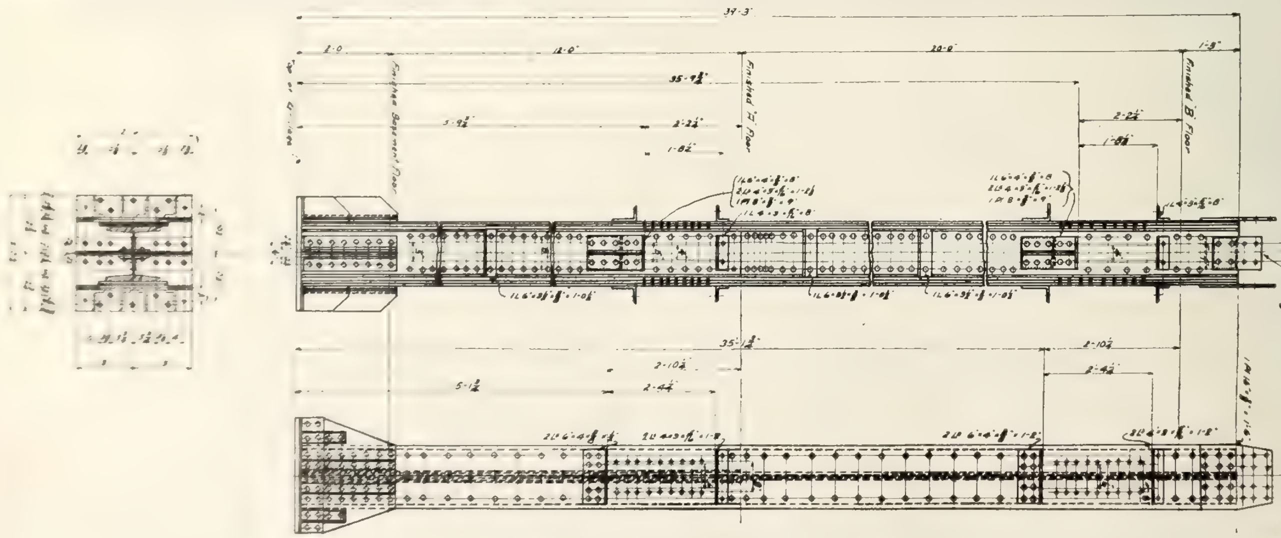


Examining Warehouse, Calgary, under construction.

The steel columns are Bethlehem "H" sections. A typical detail of columns is shown. The steel work carrying the floors consists chiefly of 28 in. x 105 ft. Bethlehem Beams between the columns with 18 in. x 55 ft. intermediate beams spaced about 6 ft. 6 in. apart, the beams all being protected with cinder concrete. The floor slab is 5-in. thick, of 1:2:4 concrete reinforced with .384 of steel per foot and continuous over as many panels as possible. These slabs are designed to carry a load of 450 lb. per sq. ft. under 24-hour test, with deflection not to exceed 1/900 of the span. The slab is not carried on the walls but is carried on 15-in. channels. The present roof is designed to be a future floor on the addition of other storeys. It is of the same strength as the rest of the building and is covered with tar and gravel roofing. The walls are designed to be entirely self-supporting and carry no loads except their own weight.

The structural steel for the building was supplied by The Manitoba Bridge & Iron Works, Limited, Winnipeg. Rapid progress has been made by the contractors, The J. McDiarmid Company, Winnipeg, and it is expected that the building will be completed well within contract time.

Cinder concrete has been put to a new use in Munich, Germany, for lining the exterior walls of the new building of the Duetsches Museum. Its purpose is to serve as insulation and also supply a base which will take nailing, etc. It is not made with ordinary ashes or cinders, but with broken tufa, or porous volcanic rock. With this material a cement concrete is mixed 1:12 or 1:16, and used to form a 5-in. layer on the inner face of the exterior wall, the rest of the wall being stone concrete. This tufa concrete permits nails to be driven in easily, and it can be worked with tools, as was proven by sawing into it at the corner of a door jamb with an ordinary crosscut saw.



Examining Warehouse, Calgary.—Detail of typical column.

Satisfactory Progress at the Coast

Development Work in All Lines Proceeding Steadily—Confidence in the Local Situation Gaining Ground—The More Noteworthy Operations

Office of the Contract Record,
June 5, 1914.

WHILE there is unquestionably a noticeable falling off in the volume of building construction actually under way at Vancouver and the vicinity compared with this time last year, the outlook for the summer months is by no means disheartening; in fact, the amount of work projected both in the coast cities and at points throughout the interior is fairly satisfactory, all things considered. It is true that in common with other Canadian cities Vancouver is feeling the pinch of hard times and for the time being has been forced to curtail building operations to a considerable extent, but it is also a fact that despite the adverse conditions prevailing development work is proceeding steadily at all points and in sufficiently large volume to warrant the greatest confidence in the city's future. Similar conditions are in evidence at other centres of population in this province and everywhere the outlook is regarded with feelings of satisfaction. At Vancouver, building prospects for June are more encouraging than for the previous month, work in connection with a number of important contracts being due to commence during the early part of the month.

Two New Vancouver Hotels

Excavation operations are under way for the foundations of the new seven-storey Blackburn hotel building to be located on Main street, Vancouver, adjoining the present Blackburn Hotel and it is believed that the general contract for the building will be awarded early in June. The construction will comprise a reinforced concrete frame with stone facing on the two lower storeys and a brick exterior for the five succeeding storeys. Provision has been made for one passenger elevator. Messrs. Boyd & Glendenning are the owners of this structure which is expected to cost approximately $100,000. Plans were prepared by Honeyman & Curtis, a Vancouver firm of architects.

It is expected that operations will commence before the middle of June on another large hotel building which is to be erected on Hastings street, Vancouver, near Columbia street, for Mr. A. Clemes, after plans by Mitton & Gillingham. This building will be erected on the site now occupied by the Hasting Rooming House and the general contract will be handled by the J. J. Frantz Construction Company. It will be a combination of steel concrete and mill construction, eight storeys in height with facing of pressed brick. Accommodation will be provided for 120 rooms, most of which will be equipped with private baths. The mechanical equipment includes an oil-burning plant to operate a steam heating system, and furnish power for two elevators, and a vacuum cleaning system. Construction work will involve an outlay of approximately $150,000.

Additional School Contracts Pending

Preliminary sketches of the new Strathcona School which have been prepared by construction superintendent Giles, of the Vancouver School board, show that the proposed building is to be of fireproof construction, probably reinforced concrete, and faced with brick and stone. It will be erected on the site of the old Strathcona School at the corner of Pender street and Jackson avenue and will be two storeys high and measure 218 feet in length, with 24 class rooms capable of accommodating 960 pupils. Only one section of twelve rooms will be undertaken this year as the amount available for building purposes is not sufficient to cover the entire contract. According to the plans this will be a decidedly attractive structure both as regards interior arrangements and general architectural treatment. It will contain in addition to the usual departments—an auditorium capable of seating 900 with a stage. It is the intention of the School Board to call for tenders without delay in order that the first section of the building may be completed this year. An expenditure of approximately $96,000 has been provided for the work.

Another large Vancouver school upon which work will commence immediately is an eight-roomed two-storey structure for which the B. C. Granitoid and Contracting Company were recently awarded the general contract after plans by Mr. F. J. Giles the constructional superintendent of the School Board. This building will be located in Hastings townsite, at the corner of Twentieth avenue and Clinton street, and will be of reinforced concrete and brick construction with provision for four additional class rooms when required. The figure of the successful tenderers was $58,275.

A contract was recently awarded to Coffin & McLennan covering the construction of a school in the Shaughnessy district, Point Grey, for the Western Residential Schools. The building will be of two storeys, with brick for the lower portion and rough cast and timber work for the top storey. It is estimated to cost approximately $70,000. MacLure & Fox, Vancouver, are the architects.

Other Important Buildings

Operations are proceeding steadily on the site of a two-storey store and office building on Pender street west, Vancouver, adjoining the Dominion Trust Building, for which the Hosking Construction Company was recently awarded the general contract. The construction of this building which measures 52 x 60 feet, will be of tapestry brick, with heavy Flemish bond. All pilasters will have stone caps and keys, and tile and marble will be used for decorating the main entrance. Mahogany is to be employed for interior trim. A steam heating plant will be installed. Plans of the structure were prepared by J. Y. McCarter for the owners, The Western Canada City Properties, Limited, and the cost of construction will reach approximately $25,000.

The Hosking Construction Company is also the contracting firm for the new $40,000 Eagles' Hall Building, Vancouver, upon which an early start is contemplated.

The Dominion Government authorities recently purchased a site in the east end of Vancouver, at the corner of Gore and Keefer streets, on which it is understood that a sub-postal station will be built this year. The property secured has a frontage of 50 feet and extends back 120 feet to a lane. The sum of $125,000 is provided for this project in the estimates recently passed at Ottawa.

Preliminary work has started in connection with the erection of a new branch building at Chilliwack for the Merchants' Bank of Canada. With the exception of the front elevation, which is to be treated in stone, the building will be a substantial brick structure, two storeys in height with full basement. [illegible] McLean & Company, Vancouver, are handling the general contract.

The New Westminster contracting firm of Miller & Jewhurst recently secured the contract for a new hotel which is to be built at White Rock for the White Rock Resort Development Company. The building will [illegible]

[illegible] of [illegible] x [illegible] feet and is estimated to cost about $33,000. In addition to the hotel it is proposed to erect a pier theatre and dance hall at the same location.

A permit was issued recently by the Point Grey building inspector for a fine residence which ex-councillor McSpadden intends to erect at the corner of Granville street and Magee road. This building will be two and a half storeys in height and will be faced with stone up to the first floor, with rough cast and half timber work for the balance. Shingles will be used for roofing purposes. Oak panelling and hardwood floors throughout are features of the interior construction. The building will contain nine bed rooms altogether and is likely to cost about $12,000. Mr. H. B. Watson is the architect.

Work has commenced on a two-storey residence of frame construction which is being erected on Belmont avenue, Point Grey, after plans by Parr, McKenzie & Day. This dwelling will be fully equipped throughout and is estimated to cost about $15,000. Mr. James Stables has charge or the contract.

Contract tenders are being invited for the proposed city hall at Port Coquitlam which has been designed by Parr, MacKenzie & Day, Vancouver. The building will be two storeys, of brick construction, with stone trimmings and excellently equipped throughout. Fir is to be employed for all interior finish. A police court and station with police cells will occupy the basement. The cost will be approximately $20,000.

It was considered probable at the end of May that contract tenders would be invited without delay for the new addition to the New Westminster courthouse, a project entailing an expenditure of $60,000. The building will measure 98 x 45 feet and is to be three storeys with full basement. It will be of brick construction with stone trimmings. Accommodation will be provided on the ground floor for the provincial police department, and the first floor will be occupied by a county court room measuring 53 x 34 feet, with offices in connection therewith, while the second floor is to be utilized for a supreme court chamber measuring 53 x 35 feet, grand jury rooms and other apartments. Messrs. Gardner & Mercer, of New Westminster, are the architects.

Nicholson & Cummings, a New Westminster firm of contractors, recently started work on a new office building for the Dominion Trust Company. The structure will be of brick with exterior facing of terra cotta on the front elevation and panelled in the interior with mahogany. The sum of $35,000 has been appropriated for construction work. Plans were prepared by Mr. H. S. Griffith.

Assurances have been forthcoming from official quarters that construction tenders for the proposed post office building at Port Coquitlam will be invited in the near future, plans for the work having been completed by the Dominion Department of Public Works. The structure will be erected at an outlay of about $40,000, half of which amount it is understood, has already been appropriated. A suitable site has been secured in a central part of the city.

Announcement has been made by Mr. G. B. Hull, Resident Engineer for the Dominion Department of Public Works at Prince Rupert, to the effect that plans of the Prince Rupert post office are now ready and that a call for tenders will be issued at an early date. This building will be five storeys and of reinforced concrete construction with brick side walls, and marble facing. The front elevation is decorated with marble columns and provision has been made for four separate entrances. The cost of the building complete will reach about [illegible].

It is believed that tenders will be invited shortly for the proposed new hospital building to be erected at Nelson, after plans by Mr. A. Currie, a local architect. According to the information available, the provincial government has already appropriated half of the $80,000 required for the work. The style of construction to be adopted will probably be reinforced concrete and brick.

Heavy Building Programme on Vancouver Island

A large programme of building construction appears to be in prospect for the present season at various points on Vancouver Island, the main volume of work contemplated being in the neighborhood of Victoria, where the majority of architects report a satisfactory outlook.

Mr. Jesse M. Warren, probably the best known and busiest architect in Victoria at the present time, has completed plans for a two-storey brick and mill construction apartment building to be erected on Yates street, near Quadra street, at a cost of approximately $30,000. This building will contain eleven two and three-room apartments equipped with wall beds and hot water heating. The entrance hall is to be finished in marble and tile. The same architect recently prepared plans for a residence which is to be erected in Victoria for Mr. J. R. Mott at a cost of about $8,000. In this building the front will be entirely of stone and the equipment throughout will be thoroughly up-to-date. Mr. Warren has plans for the following undertakings in course of preparation: warehouse, costing $20,000, to be built at Esquimalt, and a residence, costing $30,000, to be erected in the same district; a $30,000 residence for Dr. J. D. McLean, of Edmonton; an apartment house to cost $27,000.

Plans have been prepared by Mr. Warren for the remodelling of the Harris Block at the corner of Tenth avenue and Main street, Vancouver, for McPherson & Fullerton Bros. of Victoria, the owners. The structure is to be altered from a rooming house to a store and apartment building with 36 two and three-room apartments, at an expenditure of approximately $20,000. The apartments will be fitted with disappearing beds, hot water heating and modern plumbing appliances and the decoration of the main entrance vestibule will be executed in marble and tile.

Cummings & Marcom, a local firm of architects, were recently commissioned to prepare plans for a two-storey apartment building which is to be erected at Esquimalt a suburb of Victoria. This building will be occupied by five stores on the ground floor, the top floor being reserved for the apartments. The same firm have let the contract for a fireproof moving picture theatre at Esquimalt to Dunford & Sons, of Victoria. The structure will have a seating capacity of four hundred persons and will be of brick construction, costing about $7,500.

Although building details are not available at present, it is understood that Mr. J. C. M. Keith has completed plans for the new civic jail which it is proposed to erect on Fisguard street, Victoria, at a cost of about $70,000. Mr. Keith is also the architect for a church building which the congregation of the First Presbyterian Church at Victoria propose to build this summer. Tenders for the excavation of the foundations have been taken and it is believed that a general contract may be awarded at the end of May or beginning of June.

A contract was recently let to Mesher Bros., of Nanaimo, for the construction of a theatre at Cumberland, Vancouver Island, the owners of which are the Cumberland Light & Water Company, Limited. The building has been designed by Mr. E. J. Bresemann, of Victoria, and measures 44 x 126 feet. It will be of frame construction on a concrete basement and its erection will involve an outlay of approximately $25,000. The seating capacity of the ground floor will be for 1,000 persons. The interior finish is to be executed in plaster and Beaver board. Accommodation for a dance hall with hardwood doors will be provided in the basement.

Rapid progress has featured the construction of the new Pantages Theatre on Government street, Victoria, during the last few weeks and the B. C. Construction Company, who are handling the general contract, announce that the building is now about completed. The steel and brick work was erected in record time and the finishing touches to the interior decoration have been executed with great despatch.

Tenders for the general construction of the new Royal Jubilee Hospital at Victoria were being taken at the end of May but some doubt exists as to how much of the building will be proceeded with this summer. It is understood that the erection of the first half of the hospital will occupy a year at least, and involve an outlay of approximately $400,000. This estimate would cover the administration and service buildings and wards with accommodation for 200 beds. Mr Loring P. Rixford, of Victoria, prepared the plans.

The Dominion Public Works Department has plans under way for the new Marine & Fisheries building which is to occupy a site on the Songhees Reserve at Victoria. According to the limited information available, the structure will be fireproof, embodying either brick or concrete construction and will be erected during the summer.

Knott & Jones, a Victoria contracting firm, were recently awarded a general contract covering the erection of the proposed post office building at Port-Alberni, Vancouver Island. The building will have a concrete basement, with exterior facing of brick and stone, and will correspond in design with the post office building completed recently at Duncan by Rourke, McDonald & Moncrieff, contractors, of Vancouver. According to the estimate of the Federal authorities, the Port Alberni structure will cost approximately $30,000, this figure being $13,000 less than the expenditure allowed for the Duncan building.

Knott & Jones have secured a contract for the erection of a two-storey church building in Victoria for the St. Columbia Presbyterian Church, the cost of which will approximate $20,000. This will be an eight-roomed structure of frame and brick veneer construction. Mr. W. Henderson prepared the plans.

The Victoria Curling Association propose to erect a $50,000 ice rink this summer in a central locality and plans for the building are now under way by Coates & Fleet, a Victoria architectural firm.

Plans have been prepared by Mr. H. T. Whitehead for two apartment buildings, one to be erected on Government street in the James Bay district and the other on Cook street. The James Bay building will be of brick and mill construction, two storeys high, and will cost about $18,000. The Cook street structure will be of similar construction, but of similar dimensions, and will cost $12,000

Fort George Anticipates Busy Season

Building construction in the Fort George district promises to be unusually active this season on account of the increased development which it is expected will follow the establishment of regular rail connection over the transcontinental system of the Grand Trunk Pacific completed recently.

The most important contract under way at present is a four-storey hotel which is being erected for Mr. J. A. Brown, of the local firm of Bogue & Brown, by Mr. W. G. Gillette, of Vancouver. This will be a handsome structure measuring [illegible] x 120 feet of brick construction for the two lower storeys and timber and rough-cast plaster resting on a concrete foundation. Accommodation will be provided on each floor for thirty bedrooms, ten of which will have private bathrooms adjoining. The hall, lobby, office, bar and dining room, will be finished in fir. The mechanical equipment includes an elevator, steam heating apparatus, laundry, pump, electric lighting and plumbing systems. The small power plant will be installed for the purpose of generating the electricity consumed in the building. The probable cost of the building complete will be $125,000.

Mr. W. G. Gillette of Vancouver has also been awarded the general contract for a theatre which the Prince George Amusement Company proposes to erect without delay at the corner of Third and Vancouver streets, Fort George. This building, plans of which were prepared by Mr. Thos. Hooper, Vancouver, will measure 60 x 110 feet and is to be two storeys in height, with several stores on the ground floor. Seating accommodation will be provided for 650 persons. The construction will be frame with concrete foundation and the cost has been estimated at approximately $15,000.

Mr. J. Payton, a Fort George architect, has prepared plans for a three-storey hotel building costing about $20,000, to be located at that point. This structure will be occupied on the ground floor by four stores and by ninety-two bedrooms in the upper floors. It will measure 60 x 110 feet. The owner's name has not yet been disclosed.

A number of other buildings, principally store structures and dwelling houses, are contemplated for early erection, but details of these are lacking at the moment.

The Morley avenue sewage disposal works at East Toronto were visited recently by an investigating committee of aldermen as a result of the offensive odors emanating from the sludge beds. The committee have suggested that the experts who advised the city on the construction of the plant should be asked to suggest improvements. It is not unlikely that the present system will be replaced by the Imhoff tanks. The latter will probably be adopted for the North Toronto sewage disposal works.

The earnings of Messrs. P. Lyall & Sons Construction Company, Limited, for the year ending March 31 last were $230,405, a decrease of about 11 per cent. on the figures of the previous year. In his presidential report to the shareholders, Mr. Wm. Lyall expressed satisfaction with the general financial situation and spoke optimistically of the prospects for the ensuing year. Mr. Lyall stated that the company were carrying over contracts to the extent of nearly three and one-half million dollars, with the expectation of large additional works to follow.

The "Paraiso," a 15 cu. yd. dipper dredge, twin of the "Gamboa," now at work in Culebra cut, has sailed from New York in tow of a tug. These dredges were constructed by the Staten Island Shipbuilding Company. The dippers are 10 ft. 9½ ins. in height, from the bottom band to the upper edge of the lip, and each has a capacity of 15 cu. yds. They are built with manganese steel lips and dipper-door hinges of forged steel, 6 x 10 ins. in cross-section. They are hung on a 3¼ in. single-part, wire rope hoisting cable. The handle is 72 ft. long with top and bottom bars measuring 2 x 12 ins. in cross-section, and weighs 40½ tons. The dipper boom is 62 ft. long, weighs 66½ tons and is of plate-girder construction. The dredges can dig to a depth of 50 ft. below the surface of the water.

There are $11,000,000 available for railway building in Alberta this year, notwithstanding the alleged hard times. Something like seven hundred miles of new track are to be laid before the snow flies. The province is in an exceptionally good position with regard to the bonding of railways, owing to the fact that the government now has as security for its guarantees several lines in operation which have been profitable since they were opened. Other lines are either constructed between points where operation would be profitable or else very little construction has been done, and the money is still in the possession of the province. If it seems expedient for the government to take over any of these lines at the present time it can do so not only without loss, but actually at a profit—chiefly for the causes stated, that the security of the government is of the best, seeing that the lines are, in part, in profitable operation.

Personal Mention

Mr. H. L. Brown has been appointed Assistant City Engineer of Winnipeg, to succeed the late Mr. R. D. Wilson.

Mr. C. L. Howse, formerly of the Hamilton Hydro Electric Department, has been appointed Manager of the hydro-electric and waterworks systems of Peterborough, Ont.

Mr. W. R. Worthington, Engineer in Charge of Sewers for the Toronto Works Department, has been appointed District Examiner for the Royal Sanitary Institute of Great Britain.

Mr. W. Hartley Patterson, of the City Engineer's staff at Victoria, B.C., was presented recently with a service of plate by his fellow-employees in that department on the occasion of his marriage.

Mr. Donald A. Andrus

Mr. D. A. Andrus.

Mr. Donald Andrus, to whom we have pleasure in introducing our readers through the medium of this column, is engineer-in-charge for Messrs. Baldry, Yerburgh & Hutchinson, Limited, contractors for the No. 2 section of the Welland Ship Canal. He received his professional training in London, Eng., and was appointed in 1890 assistant engineer with the Ottoman Railway Company in Asiatic Turkey on the construction of an English line planned originally as the overland route to India, via Bagdad and the Persian Gulf, with terminus at the port of Smyrna. After ten years' service with this company on location and construction, Mr. Andrus proceeded in 1901 to Egypt where British engineers were remodelling and re-organizing the ancient irrigation system of that country, under the guidance of Sir William Willcocks, one of the foremost irrigation engineers of the present day and famed as the designer of the great Assouan Dam on the Nile. Mr. Andrus spent ten years in Egypt on canal construction and other irrigation works. During this period he was engaged for two years on the widening of the Suez Canal. The design and construction of the great undertaking with a section of which Mr. Andrus is now identified was the subject of a detailed article in our issue of March 11, 1914. Mr. Andrus' section, No. 2, comprises four and one-half miles between Port Weller and Thorold and includes locks Nos. 2 and 3. The earthwork which will have to be removed amounts to some 6,500,000 cu. yds. The concrete in the locks has been estimated at 600,000 cu. yds. Preliminary work on Section No. 2 was commenced last December. At the present time Mr. Andrus has three steam shovels and two drag line excavators in operation.

Mr. S. G. Strickland, who has just been appointed General Manager of the Chicago and Northwestern Railway, began life as a telegraph operator upon the Canadian Pacific Railway.

The retirement of Major Leonard as National Transcontinental Commissioner is foreshadowed in the introduction of a government bill to empower the Minister of Railways to act in this capacity.

Mr. G. F. Barslow, who has been engaged on location work in this country for the Grand Trunk Pacific Railway, has been appointed District Engineer of the Minnesota Highway Commission, and is now at Stillwater, Minn.

Mr. Bion J. Arnold, whose services were retained in connection with Toronto's transportation problem, has been appointed to a railway terminal commission which will make a comprehensive study of the Chicago terminal problem and report in January next.

Sir Wm. Willcocks, the eminent English engineer, to whom passing reference is made in the note on Mr. Donald Andrus, has been retained by the United States government as consulting engineer to the Reclamation Service. Sir William left last week for Arizona points. He will make a tour of inspection of all the United States reclamation projects.

Mr. Thos. Adams, the English town planning expert retained by the Local Government Board of London, gave an illustrated lecture on town planning at Brantford last week. The meeting was attended by members of the Civic Improvement Committee, the City Council, the Board of Trade and other local bodies.

Mr. C. W. Power, assistant engineer in charge of Railways and Bridges under Works Commissioner Harris, of Toronto, is resigning to accept a position with the Canadian Stewart Company on the Toronto harbor work. Mr. E. G. Hewson, Divisional Engineer of the G. T. R. is named as the possible successor to Mr. Power at the City Hall.

Mr. A. D. Swan, consulting engineer, Montreal, has been retained by the Bristol, (Eng.) Docks Committee to give expert opinion in a law suit regarding harbor construction about to be heard in London. Mr. Swan, who is also consulting engineer to the Vancouver Harbor Commissioners, is to complete negotiations in London for the construction of a large new graving dock at Vancouver, plans of which have already been passed by the Dominion Government.

Necrology

Mr. W. R. Perrin, the well-known Chicago architect who prepared the plans for the civic abattoir in Toronto, died last week. The late Mr. Perrin was born in Indianapolis fifty-four years ago.

Mr. L. L. Gay, a young engineer of much promise, who was specializing in irrigation work, died last month in Montreal. He was born in Vermont in 1879 and was a graduate of the Sheffield Scientific School of Yale University. For several years he was in the United States Reclamation Service, but resigned to accept a position as engineer on a large irrigation project in California. His death resulted from tuberculosis.

Mr. Charles C. Nugent, a civil engineer in the service of the Canadian Pacific Railway for the last seven years, died at Hamilton, Ont., on June 1 from fracture of the skull caused by a fall from his motor cycle when on his way from Hamilton to Toronto. Mr. Nugent, who was a son of Sir Percy Nugent, Bart., Multyfarnham, Ireland, came to Canada seven years ago. He was attached to the Bridge Department of the C. P. R. at Montreal.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

A contract for the construction of brick sewers amounting to $276,000 was awarded last week by the city of Montreal to Alfred Pion, a local contractor.

The Port Arthur armoury, which is costing some $200,000, exclusive of the site, is nearing completion, according to a report received from the contractor, Mr. A. C. Stewart.

A residence, estimated to cost $100,000, is in course of erection at Outremont, Que., for Mr. T. N. Hebert. The architect is Mr. Thos. Daoust, 26 St. James Street, Montreal.

At Quebec City, a church to be known as the Wolfe Memorial Church is to be erected at a cost of $200,000. The architect is Mr. R. A. Cram, of Boston. Plans have not yet been accepted.

For the month of May the Montreal building permits totalled $2,517,148, an increase of $43,450 on the corresponding month last year. The total to date is $6,578,501, a decrease of $1,085,630.

Foundation work is in progress on the new customs house which is to be erected at Fort William, Ont., at a cost of $375,000. The building is to be three storeys high, of concrete and brick construction. The general contractor is M. H. Braden.

The R. C. Cathedral which is being erected at Chicoutimi, Que., at a cost of $300,000 is well advanced and ready for roofing. The building is of stone and steel construction. Mr. R. P. Lemay, Quebec, is the architect, and Mr. J. Giroux the general contractor.

At Montreal, plans have been completed for the erection of a one-million-dollar factory building for Henry Morgan & Company, Limited, a local firm. The building will be ten-storeys high, of reinforced concrete, terra cotta and brick construction. Operations, it is said, will probably be commenced this year.

The construction of a dam across the St. John River at Meductic is proposed by the St. John River Hydro-Electric Company. The project has been laid before the legislature, and its promoters claim the work will cause an ultimate expenditure of some $3,650,000. The proposed dam will cross the St. John at Meductic above Fredericton and transmit power to Fredericton and Marysville down the valley of the river over 80 miles to St. John.

At Montreal a comprehensive scheme for improving and beautifying the city has been drawn up by Mr. M. Lavoie, a local engineer who specializes in city planning work, and presented to the Board of Control. The proposed outlay would involve many millions, and the plans involve the construction of several buildings, bridges and boulevards. The centre of the scheme is to be a building close to the present Place Viger station, to be used as a union depot. A ten-storey structure is suggested and the proposal is that it should include a public market, offices and other departments. The carrying out of this scheme would necessitate the moving south of several lines of railroad track. By the building of a bridge across the river and the extension of the Jacques Cartier pier and the Guard pier, Mr. Lavoie is of the opinion that a harbor basin, where all the largest ships dock, could be made completely land-locked in winter.

With the object of co-operating on subjects of mutual interest, the general contractors of Montreal have formed an association and adopted a constitution and by-laws. The organization is in no way antagonistic to similar bodies, but the members are of opinion that they have interests, apart from the various sections of contractors, which warrant the formation of an association. Many of the largest contractors in the city have become members. The officers are:—Mr. J. Penrose Anglin, of Anglins, Limited, president; Mr. E. G. M. Cape, vice-president; Mr. W. Clement Munn, secretary of the Atlas Construction Company, secretary-treasurer; board of directors, Mr. E. Boyer, Laurentian Construction & Engineering Company, Limited; Mr. Donald Ross, of George Ross & Company, Mr. R. Lessard, of T. Lessard & Company, and Mr. Ekin, of the Fuller Construction Company.

At Fort William, an expenditure of some $250,000 has been made on the Superior Brick Company's plant which is now in operation. With satisfactory conditions obtaining this season a successful run of business is anticipated. The plant is situated on the banks of the Kaministiquia River and the C. N. R. spur runs right into the property. The company was organized in 1912 by Mr. A. A. Ayer, president of the A. A. Ayer Company, of Montreal, and formerly a director of the National Brick. Mr. Ayer has some experience in brick enterprises, he having been one of the original promoters of the Laprairie Company, with which he was associated until its absorption by the National Brick. With Mr. Ayer is associated Mr. G. F. Stephens, the paint man, of Winnipeg; Dr. Milton Hersey, Government Analyst, Montreal; Mr. George P. Hartt, Montreal; Senator D. Derbyshire, W. Graham Brown and other eastern men.

The large plant at Varennes, Que., of the Mount Royal Brick Company, Limited, is being put into operation. The company has had a number of serious delays but the plant is now in readiness. Considerable business has already been offering, we understand. During the week, in fact, an order for 12,000,000 bricks has been placed before the company. So far, however, officials have been reluctant to take on a heavy amount of business until confident that the plant was ready to begin manufacture. Discussing the outlook for business this year, a director admitted that there was little prospect of a building boom. Few large buildings were being contracted for. But the demand for residential building was exceedingly good and the orders for the coming season would be for this character of work. Once the plant gets into operation it is highly probable that it will be kept busy for the summer.

WESTERN CANADA

Following the recent letting of the contract for water main construction by the Edmonton Commission Board, an injunction has been applied for to restrain the Mayor and City Clerk from signing contract No. 1 for constructing water mains in the Glenora, Westmount and Delton districts of Edmonton. In the application for injunction partiality is alleged in the awarding of the contracts. Messrs. Graham & McMahon having been given the contract notwithstanding that their tender was not the lowest, and that the bid of Mr. C. L. De Valle was $11,000 lower than any of the other tenders. The City Engineer's reason for not recommending the award of the contract to the lowest tender in this instance was due to a difference of opinion regarding the method of trench digging proposed by the DeValle Company.

The National Paving & Construction Company, Winnipeg, have a contract for paving at Assiniboia, Man., running into more than $166,000.

Messrs. R. J. Lecky Company, Limited, Regina, Sask., have the contract for the courthouse to be erected at Swift Current, Sask., at a cost of $103,000.

Regina building permits for the five months of the present year ending May 31 total $1,179,970, as compared with $1,915,135 for the corresponding period of 1913.

The Winnipeg Athletic Club have selected a site for a 16-storey, fireproof building estimated to cost $750,000. Messrs. Pratt & Ross (Electric Railway Chambers, Winnipeg) are the architects.

Building operations have commenced on the new hotel at Fort George, B.C. The estimated cost is $125,000. Mr. Herbert Peyton is the architect, and Mr. W. G. Gillette, of Vancouver, the general contractor.

The Vancouver building permits last month totalled in value $524,380, the total for the five months being $1,820,984. The corresponding figures last year were $1,029,657 and $6,209,372. The figures are issued by Mr. S. H. Jarrett, Building Inspector.

At Winnipeg, work has been commenced on the last unit of the Grain Exchange building, the total cost of which will run into half a million dollars. The architects are Messrs. Jordan & Over, and the general contractors Messrs. Carter, Halls, Aldinger & Company, both local firms.

Messrs. Grant, Smith & Company & McDonnell, Limited, Vancouver, B.C., have awarded sub-contracts for wharves and docks at Victoria, amounting to two and one-quarter millions. A large contract for cement goes to the Vancouver Portland Cement Company and the Bamberton Cement Company.

At Vancouver, B.C., operations are to commence shortly on a new hotel for Mr. A. Clemes. The building will be eight storeys high and will cost $150,000. Messrs. Mitton & Gillingham, Vancouver, are the architects, and Messrs. J. J. Frantz Construction Company, Vancouver, the general contractors.

At Edmonton, Alta., building operations have been commenced on the new Central police station which is to be erected for the city at a cost of $250,000. The building is to be of brick and it is being erected by day labor under the City Construction Department. The architect for the city is Mr. A. Jeffers.

A bill to amend the Dry Docks Act was given a third reading in the federal parliament on May 22. If passed it will make possible the construction of a dry dock at Vancouver by increasing the rate of interest the government will pay for a period of thirty-three years from 3½ per cent. to 4 per cent.

At Saskatoon, a students' residence in connection with the University of Saskatchewan is to be built at a cost of $104,000. The excavations for the building are now completed. Messrs. Brown & Vallance, of Montreal, are the architects and Messrs. Richardson Builders, Limited, the general contractors.

There are between 300 and 400 men working on the Government interior storage elevators, which are being erected at Moose Jaw, Sask., at a cost of $1,500,000. The capacity of the elevators is to be 3,500,000 bushels and they are being so constructed that this quantity can be readily increased to 20,000,000 bushels.

The normal school at Camrose, Alta., has begun to take definite shape. Good progress has been made in construction and the exterior is nearing completion. The cost is estimated at $145,000. Mr. R. P. Blakey, of Edmonton, is the architect, while the general contractors are Messrs. Read, MacDonald & Brewster, Limited.

Messrs. Claydon Brothers, Winnipeg, are the general contractors for a new school building which is to be erected in that city at a cost of $150,000. The building will be three storeys high, with basement, and will be of stone, brick and reinforced concrete construction. Mr. J. B. Mitchell, architect for the Winnipeg Public School Board, prepared the plans.

The cities of Moose Jaw, Saskatoon and Regina may cooperate with a view to securing natural gas. Since Eugene Coste has withdrawn his proposition, the Saskatchewan cities have been talking of taking united action with a view to drilling for gas in the province of Saskatchewan. The aldermen of the various cities have already talked the matter over informally, but no official action has yet been taken.

E. G. Prior & Company, of Victoria, B.C., have been awarded the contract for all the steel work in the new government piers at the outer wharf, amounting in tonnage to between 6,000 and 7,000, and in value to about $250,000. Each pier is about 1,000 feet long and some 80 feet deep. Another important contract secured by E. G. Prior & Company is the steel work for the new Hudson's Bay Lock at Victoria, which involves about 1,200 tons of steel and an expenditure of $60,-

At Victoria, B.C., operations are proceeding night and day at the site of the Dominion government dock on Burrard Inlet, between Salsbury and Commercial Drives. A drill scow, built specially for the submarine work by the contractors, Messrs. Henry, McFee & McDonald, is moored close to the shore with its battery of five drills. A line of holes has been bored from the outer edge along the western fringe of the wharf site and dredging operations will be started without delay. The Pacific Dredging Company, which has the sub-contract for removing the rock, is commencing operations with one of its largest dredges. The site for the shore portion of the dock is now practically cleared and as soon as sufficient material has been dredged the construction of the foundations for the wharf will begin. More than 200,000 yds., the equivalent of 400,000 tons of rock, will require to be excavated for the foundations.

Suggested Town Planning Scheme for Calgary

An extensive preliminary town planning scheme has been submitted to the city planning commission of Calgary by Thos. Mawson & Sons, the English town planning experts.

The drawings received, although preliminary, are comprehensive. They consist of a plan showing the general scheme within the city limits; a plan of the civic centre and surrounding district, and a perspective drawing showing how this may look many years hence. These are supplemented by sections and elevations in which suggested public buildings are treated in an ideal manner. Numerous plans of the entire city illustrate the adaptability of Mr. Mawson's scheme for fire control; the extension of the car service, the development of a park and boulevard system, the determining of the main traffic routes; the location of new school sites; proposed new factory sites; the enlargement of existing and development of new shopping centres. There is also a plan showing Calgary and surrounding district, on which is indicated proposed automobile roads between the city and surrounding beauty spots. Accompanying the main plans are numerous detail drawings illustrating the suggested treatment of portions of the scheme including plan showing proposed arrangement of workmen's area in east portion of city, a plan of a similar area with details of dwellings in the south portion of the city, and plan of suggested rearrangement of exhibition buildings in Victoria Park. In addition to plans there are various perspective drawings illustrating the possibilities of the scheme with regard to the C. P. R. depot, Centre street, and proposed new market situated on Centre street, south of C. P. R. track; the Centre street bridge, showing alternative scheme of high and low level bridge, the advantages and otherwise of either scheme being dealt with in the report.

The report contains diagrams relating to traffic problems, numerous photos of beauty spots in the vicinity of Calgary, and illustrations for the purpose of comparison with city planning schemes in other cities. Many of these drawings are colored and the perspectives, while they illustrate buildings which are not likely to be erected for a long time, are valuable as illustrating what can be accomplished in the future, it being pointed out that Paris is still working on Hausmann's plans, prepared about eighty years ago and that the city of Boston, has undertaken a scheme which it is intended to spread over a period of 30 years. Chicago has plans which require a period of 100 years for their completion.

Existing conditions in Calgary are considered as they apply to the task of the city planner and the factors which influence the growth and development of the city. Special reference is made to the importance of Calgary as a railway and distributing centre, and its possibilities as a manufacturing centre. Uniform width of streets is condemned as uneconomic, and it is suggested that main traffic routes of considerable width be established, as a result of which the width of paving on residential streets could be greatly reduced. The proposals for street car extensions are arranged so as to make use of practically all existing routes.

The C. N. R. in British Columbia

The construction of the Canadian Northern Railway line in British Columbia from the Yellowhead Pass to tidewater is an undertaking of many difficulties. The Fraser River canyon, which extends from Yale to Lytton, a distance of forty-five miles, is one of the most difficult stretches of railroad construction, as well as being among the most costly. The heaviest mile on this section will cost $326,000. From Yale to Boston Bar, which includes 26 miles of canyon, the rock work was extremely heavy and there are fifteen tunnels aggregating 8,321 feet. The rock is mostly granite and bluff follows bluff, all with practically perpendicular faces, running to about 5,000 feet above the river. Construction was begun from Port Mann to Hope in July, 1910, a little less than four years ago; from Hope to Kamloops in August, 1911; from Kamloops to Birch Island in October, 1911, and from Birch Island to the Yellowhead Pass in May, 1912. The total length of the British Columbia section is 495 miles. In that distance there are only twenty-two miles of adverse grade. Grading has been completed almost the entire stretch through this province, while steel has been laid on about three-fourths of the entire distance. Several big steel bridges have to be completed, this work being done by the Dominion Bridge Company, of Montreal. The bridge across the Fraser at Cisco will be 910 feet long, with a central span of 400 feet. This will be finished in less than two months. The Fraser is re-crossed again at Lytton, and three-quarters of a mile farther on the route crosses the mouth of the Thompson River, it being considered less costly to build these two crossings than one large one across the Fraser. Two miles of work at Gladwin's Bluff cost $227,650 each, and stretches at intervals farther East ran into high figures also. On the entire British Columbia sections there are forty-two tunnels and half that number of high steel bridges. The longest bridge is over the North Thompson River, at Kamloops, it being 1,209 feet in length. The longest tunnel is at Kamloops Lake, 2,835 feet, while the Yale and "Hole in the Wall" tunnels in the Fraser canyon aggregate 3,874 feet. These facts are quoted to point out the costly nature of the undertaking. The principal contractors have been The Northern Construction Company.

Fibre Asphalt Plant for Toronto

Geo. A. Henderson, of St. Albans, West Virginia, announces that a Canadian company has been organized to manufacture the new pavement "Fibred Asphalt," patented in Canada by Mr. Henderson last December. It is proposed to erect a $20,000 factory in Toronto, where graded hardwood fibre will be impregnated. A test pavement, the first of fibred asphalt in Canada, will be laid in Toronto. The Good Roads Year Book of the American Highway Association publishes the following:

"The invention relates principally to the art of denaturing hard-wood and preserving it in the following manner: A billet of hard-wood is shredded into small particles of uniform lengths of 1½ inches down to wood flour, the flour itself being eliminated from the aggregate by screening. The particles are denatured by the process used by the tannin extract manufacturers, in which process all sap, essence and the more evaporable and deteriable elements in the wood are extracted, the remaining particles being thereby rendered abnormally enlarged and porous. In their subsequently dried and heated condition the wood particles, because of their porosity, are susceptible of impregnation, by absorption, by a non-deteriable, non-evaporating matter—(such as asphalt), in lieu of the sap, etc., removed. The heating of the dried particles to prevent the premature congealing of the molten asphalt before reaching the particles' pores, has also for its object the partial contracting of the enlarged particles. The consequent contraction in the size of the particles' pores correspondingly reduces the amount of asphalt required to completely fill them.

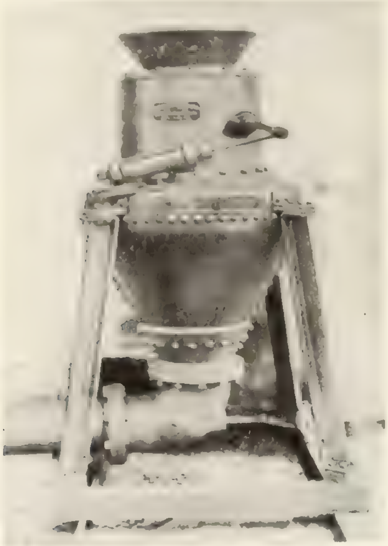
"The wood fibre is a waste product of tannin extract manufacturers, who use hard-wood and no bark in their process. The particles are taken from the leaches on endless belts; dried, screened, heated and then mechanically mixed with a predetermined uniform percentage of asphalt, sufficient to fill the pores and voids in the mass when finally contracted and compressed. The material, in its partially impregnated and partially contracted condition, is deposited at the mouth of its mixer into moulds 4 by 6 feet, these blocks being compressed on all sides only 3 to 4 inches, and allowed to cool, when they will remain intact for shipment, but are readily disintegrated in a breaker stationed at the front of a portable re-heating machine, designed to travel over the road to be paved, in which machine the coated particles are deposited and heated to from 250 to 275 degrees F.

"This heating results in the final contraction of the fibre to its normal size, as it was before being shipped from its original log, and the entrapping of its asphalt content, thereby insuring penetration to the most minute pore of the fibre, thus thoroughly preserving it, without affecting its natural resiliency. The mass emerges from the rear of the re-heating machine in a continuous 18-inch flow onto the previously prepared road base, where it is mechanically spread 4 inches thick; steam roller compression immediately reducing it to a compact mass 2 inches thick.

"Fibred asphalt may be laid on any substantial foundation, such as old macadam, crushed stone, concrete, old brick, granite or wood blocks, or [illegible]. [illegible] country roads a curb or shoulder is not necessary."

Mixing and Placing Concrete by Compressed Air

An interesting method of mixing and placing concrete by the use of compressed air has been attracting the attention of engineers and contractors. The idea is not new, and for some time there have been upon the market machines which utilize air pressure to convey grout through a pipe, or project it against vertical walls for stucco work; but it is only within the last few years that a process has been developed for using air to both mix the materials and convey the concrete to the forms. This method is now well established on a commercial basis, there having been in operation for the last three years machines which handle aggregate of large size and mix and place concrete at the rate of from fifteen to forty yards an hour.



Pneumatic Mixer.
(Pneumatic Concrete Placing Company of Canada)

The mixer consists essentially of an inverted boiler plate cone, standing vertically, having a door in the top for the admission of materials, with a cast steel elbow at the bottom through which the concrete is discharged to the conveyor pipe. The door is operated by a small pneumatic piston, and nozzles are provided for the admission of air into the top of the cone and in the elbow at the bottom of the mixer.

The operation of the mixer is very simple. The aggregate, cement and water in the proper proportions, is admitted through the door, which is then closed; the compressed air, at 80 lbs. pressure, is turned on, and the batch is forced through the pipe, it being mixed as it leaves the mixer and in the first few feet of pipe. Tests on concrete made in this manner show results that are at least as high as concrete made in the ordinary manner.

This method was used to good advantage on the Riverside plant for the Otis Steel Company, at Cleveland. Here the foundations contain about 25,000 cu. yds. The building was located on the flats and the foundations rested on piles. The piers, about 300 in all, averaged 20 feet in height, and the lot—400 by 800, will be filled in with slag and earth. The mixer was located at one side of the lot with its top flush with the ground, and a bin with a capacity of 80 yds. crushed slag and 30 yds. sand was built over it. The bin was loaded from cars or stock pile by a crane, the materials discharging by gravity into a measuring hopper. The cement was placed in this hopper which discharged directly into the mixer. An Ingersol-Rand compressor, of 600 ft. capacity, driven by a 100 h.p. electric motor furnished the necessary air at 80 pounds pressure. An old boiler was used as a storage tank. The pipe used was 8-in. lapweld steel pipe with flanged ends. For the mattresses over the tops of the piles the concrete was discharged through a 45 elbow directly into place. For the piers a goose-neck arrangement was used. This consisted of a vertical pipe, about 20 ft. long, connected at the top to a

Discharging from pneumatic mixer at 200 feet.

horizontal pipe which discharged through a 90 elbow directly into the forms. The whole arrangement was set on a raft and the lower end of the vertical pipe connected by a swivel joint to the pipe main on the ground. This goose-neck could be used to pour two piers by turning the discharge arm on the swivel joint; then the flanges at the bottom disconnected and the entire apparatus rolled to the next two. For moving any distance it could be picked up as a unit, by the locomotive crane, and placed in the new location.

As this job necessitated placing a large number of small units, a small size mixer was used and the average batch was ¼ yard. The mixer force consisted of five men as follows: One man filling sand and stone hopper from bin; one man carrying cement; one man putting cement in measuring hopper; one man operating bottom valve of measuring hopper and putting in the water; one man operating mixer.

The average daily speed for distances up to 600 feet was one batch a minute or 15 cu. yds. an hour. On work involving larger quantities a ½ cu. yd. mixer is used which gives an average of 30 cu. yds. an hour. Where the special nature of the forms made it necessary, two or three men were used at the distributing end. By use of small open chutes the concrete was placed where desired.

Otis Steel Company's plant, showing gooseneck on conveyor pipe.

The contractor for this work was P. T. McCourt, of Cleveland, and the work was under the supervision of Mr. Bowman, Chief Building Inspector for the Otis Steel Company. The pneumatic equipment was installed by the Pneumatic Concrete Placing Company, 45 Broadway, New York.

An economical application of this method is in tunnel lining. A portable plant is at present in operation on the Chicago, Burlington and Quincy Railway, for lining a tunnel where the concrete has to be placed without disturbing the traffic. The plant is self-contained and consists of a Pneumatic Mixer and Conveyor mounted on a flat car with material bins, cement storage, and water tanks. A standard 40-ft. flat car is used, and material bins which slope to the centre are built on each end. Cement and water storage is provided under the slope of the bins. The aggregate, which, in this case, is bank run gravel, runs from the bins into a measuring hopper, into which the required amount of cement is placed. This hopper is raised and dumped into the mixer by a cable operated by a small air piston. The compressed air main is laid through the tunnel and connection can be made to the car at any point. The bins, which hold enough material for 25 cu. yds. of concrete, are loaded, and the car is run into the tunnel and connected to the air line. The mixing and placing of this 25 yards takes one hour and the operating crew consists of four men: One operating bin gates to measure the materials; one carrying cement; one dumping cement into the measuring hopper; one operating the mixer and all valves. This car was equipped for the railroad by the Concrete Mixing and Placing Company, 123 W. Madison Street, Chicago.

While many engineers were at first quite doubtful as to the quality of the concrete made by this method, the results of many tests have proven that this concrete is equal to the best concrete made by the ordinary methods. The fact that the water is in contact with the cement for a few seconds only, and that the movement through the pipe continues the mixing process and allows no separation of ingredients, may account for the excellent quality of concrete obtained.

This machine is patented, the Canadian rights being held by The Pneumatic Concrete Placing Company of Canada, 1014 Transportation Building, Montreal, who have recently commenced leasing these mixers in Canada and who state that several plants will be in operation shortly.

Coming Events

The American Society of Engineering Contractors will hold its midsummer convention July 3-4, at Brighton Beach, New York. The Secretary is Mr. J. R. Wemlinger, 11 Broadway, New York.

The annual meeting of the American Society of Testing Materials is to be held June 30-July 4 at Atlantic City. Professor Marburg, of the University of Pennsylvania, Philadelphia, is the Secretary.

Plans for the Eleventh Annual Convention and the Sixth Annual Good Roads Show to be held in connection therewith were discussed at a special meeting of the Board of Directors of the American Road Builders' Association held in Montreal on May 20th. This meeting had been called owing to the attendance of a large number of the directors of the Association at the First Canadian and International Good Roads Congress. The programme covering the Annual Convention and Show is now being prepared and the list of speakers will include the men who are known the country over as the leading experts in their respective lines. The first Good Roads Show was that given under the auspices of the A. R. B. A., and the show this year in Chicago will be the largest and most elaborate ever attempted. It will be participated in by a much larger number of exhibitors than have ever taken part in a similar show, and the Executive Committee are now working on plans calculated to make it most instructive from an educational point of view. A large number of the states will make exhibits, consisting of testing apparatus, constructional methods and so on. Assurances are given that the leading cities will make creditable exhibits.

Announcement is made that the United States Steel Corporation and its subsidiary companies propose to have a comprehensive exhibit of its operations at the Panama-Pacific Exposition in San Francisco in the year 1915. The exhibit will begin with the ore fields and carry on an educative picture of the firm's operations in ore mining, rail and water transportation, dock operations, coal, coke and pig iron production, and steel manufacturing in its various lines.

In a note regarding the Nova Scotia Construction Company, published on page 683 of our issue of May 27, the number of concrete piles driven in connection with the firm's contract for the government pier at the north end of Halifax harbor should have been 1,600, instead 160,000, as was reported owing to an unfortunate typographical error. Some 1,900 piles in all will be driven. The cost of the work is in the neighborhood of $1,000,000.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brock, Sask.

The village council has under consideration the construction of sidewalks and the purchase of road machinery.

Battleford, Sask.

The construction of waterworks is proposed by the town council. Permission has been granted by the Provincial Government to raise the sum of $30,000.

Brampton, Ont.

The town council has given authority to the water commission to start work on the new water main on Queen St.

Calgary, Alta.

Tenders will be received by the City Commissioners until 1 p.m., June 24th, for the supply and delivery and duty paid at Calgary of 100 1-in., 50 ¾-in. and 20 2-in. water meters, positive frost proof case or bottom. Engineer, A. W. E. Fawkes, City Hall.

Ford City, Ont.

Tenders will be received by the engineer, Owen McKay, Walkerville, who has plans and specifications, until June 18th, for the construction of 4,000 ft. brick and arch sewers, with catch basins and lot connections.

Fredericton, N.B.

The municipal council has under consideration the construction of 4 blocks of tarvia pavement. The work will be done during the summer.

Mortlach, Sask.

The construction of roadway is being considered by Wheatlan's Rural Municipality. Sec.-treas., G. F. Cliff, Mortlach.

Medicine Hat, Alta.

The city council has decided to construct concrete sidewalks under the supervision of the engineer, A. K. Grimmer.

Montreal, Que., St. Lambert

Plans for the laying of about 25,000 to 30,000 lin. ft. concrete sidewalk and curb and sidewalk curb and gutter, are at the office of the engineer, E. Drinkwater, who will receive tenders until 6 p.m. June 15th.

Ottawa, Ont.

Plans for the following paving have been drawn by the city council. Tarvia pavement on Carling St., tarvia surface 2,985 sq. yds., curb and gutter 965 lin. ft., gutter 965 lin. ft., cost $6,796; wood block pavement on Clarence St., between Anglesea Sq. and St. Patrick St., wood block 2,107 sq. yds., curb and gutter 30 lin. ft., gutter 1.015 lin. ft., headers 105 llin. ft. gutter 1,015 lin. ft., headers 105 on O'Connor St., between Laurier and Lewis Sts., asphalt 7,800 sq. yds., curb and gutter 3,633 lin ft., gutter 30 lin. ft., headers 272 lin. ft., cost $28,000; York St., wood block pavement 5,896 sq. yds., curb and gutter 1,190 lin. ft., gutter 3,009 lin. ft., headers 82 lin. ft., cost $28,800; Broad St., asphalt 3,166 sq. yds., stone blocks 2,122 sq. yds., curb and gutter 880 lin. ft., gutter 1,087 lin. ft., headers 200 lin. ft., cost $22,656; Stirling St., asphalt 3,246 sq. yds., gutter 2,741 lin. ft., headers 131 lin. ft., cost $12,290; Tormey St., macadam tarvia finish between Charlotte and Coburg Sts., macadam 1,250 sq. yds., gutter 800 lin. ft., headers 30 lin. ft., cost $2,662.

The following paving is also proposed by the city council. Asphalt pavement on Kent St., between Wellington and Catherine Sts.; asphalt pavement on St. Joseph St., from St. Patrick St. to the end of the street; pavement on Monk St., between 5th Ave. and Wilton Cres., the material has not yet been decided upon.

The city council proposes to purchase a trench rammer, worked either by steam or gasoline.

Rocky Mountain Park, Alta.

Tenders will be received by W. W. Cory, Dept. of the Interior, Ottawa, until noon, June 17th, for the construction of (a) No. 2 Section of Banff Castle Highway from Station No. 170 x 00 to Station 504 x 00; (b) No. 4 Section of Castle Vermilion Highway from Station 120 x 00 to Station 478 x 60. Plans and specifications are at the office of the Commissioners of Dominion Parks, Ottawa, Ont. Chief Supt. of Dominion Parks, Edmonton and Supt. of Rocky Mountain Park, Banff, Alta.

Rosetown, Sask.

The Fairview Rural Municipality No. 258 propose to expend the sum of $5,000 on road improvements.

Redcliff, Alta.

By-laws authorizing extensions to the waterworks and electric lighting systems, at a cost of $90,000, have been carried by the ratepayers.

Sault Ste. Marie, Ont.

Tenders addressed to the Mayor will be received by the city clerk, C. J. Pim, until 5 p.m. June 15th, for the construction of about 12,000 sq. yds., concrete pavement, 1,800 sq. yds., vitrified brick pavement, 20,000 sq. yds., asphaltic concrete or bitulithic pavement, 5,000 sq. yds., "Dolarway" or pavement with similar top dressing, 1,400 sq. yds., hard stone blocks or hillside vitrified brick pavement. Specifications are at the office of the engineer, W. W. VanEvery.

The town council proposes to construct permanent pavements on a large number of streets.

Toronto, Ont.

The following public work is recommended by the Commissioner of Works, R. C. Harris: cement concrete sidewalks, $52,305; concrete pavements, $217,985; asphalt, $63,705; bitulithic, $25,166; brick block, $10,381; tile pipe sewers, $39,917.

The Board of Control propose to lay a plank roadway on Bloor street from high Park Ave. to Keele street to facilitate operation of motor bus line from West Toronto to Roncesvalles and Boustead Aves.

The Scarboro township council has filed an application with the Railway Board to compel the Canadian Northern Railway Company to construct the subway on Dawes Rd.

New Toronto, Ont.

Tenders close with the town clerk, G. D. Scott, on June 12th, for the supply and laying of cast iron water mains, valves, hydrants, etc., steel water tank, also the supply of steel intake pipe.

Wawota, Sask.

The Walpole Municipality No. 92 has been authorized by the Provincial Government to raise the sum of $6,000 for road construction.

CONTRACTS AWARDED

Amherst, N.S.

The town council has awarded to J. N. Fage, 72 Havelock St., and J. E. Lusby, 59 Lr. Victoria St., the contract for concrete pavement, at $1.98 per sq. yd., sidewalks on 4 streets, 3,849 sq. yds., at $1.22 per sq. yd. The Canada Cement Company will supply the chief ingredients for paving. The contractors propose to purchase a Batch concrete mixer to be run by gas engine.

Assiniboia, Man.

The municipal council has awarded to the National Paving & Constr. Company, of Winnipeg, the contract for the construction of paving from the Winnipeg city limits to Headingly, a distance of 5½ miles.

Brampton, Ont.

A contract for the construction of concrete sidewalks on various streets has been awarded by the town council to Wm. Rowe, Mill St., at 67½c per ft. Material will be supplied by the town.

Jarvis, Ont.

The village council has awarded to Curran & Clement, of Orillia, the contract for laying 10,624 sq. yds. concrete, at $1.40 per sq. yd.

Kamsack, Sask.

The following contracts have been awarded by the town council. L. U. Schruth (A) labor for laying watermains and sewers, (R) labor and material for construction of concrete reservoir, (T) concrete walk; Dominion Bridge Co., Canada Bldg., Winnipeg, (C) material and erection of water tower, (D) supply of cast iron pipe; Jenkins Bros., of Montreal, (E) fire hydrants and valves; North West Constr. Company, (X) labor and material for construction of sewage disposal works; Summit Engineering Co., (S) furnishing sewer pipe.

Montreal, Que.

A contract has been awarded by the Board of Commissioners to the Warner-Quinlan Asphalt Company, 725 St. Catherine St. W., for the construction of 7½ miles of asphalt roads and 15 miles of concrete combination crub and gutter.

The contract for the construction of main brick sewers in Emard Ward has been awarded by the Board of Commrs. to Alfred Pion, 1300 Papineau Ave.

Montreal, Que., St. Laurent

Contracts for permanent sidewalks have been awarded by the town council to F. D. Beaulieu and A. Dufresne.

Oshawa, Ont.

The town council has awarded to W. Flintoff a contract for the construction of 50,000 sq. ft. cement concrete sidewalgs at 11c per sq. ft.

Regina, Sask.

The following contracts for waterworks supplies have been awarded by the city council. Canada Iron Corporation, of Montreal, cast iron pipe and specials, at $60,165.97; Jenkins & Hardy, of Montreal, 50 tons ¾-in. lead pipe, at $6,100; Metals, Ltd., of Edmonton, iron pipe, at $496, 8,000 lbs. jute rope, at $450.40, 50 2-in. gate valves, at $110; Mueller Manufacturing Co., of Sarnia, Ont., brass goods, at $4,040; Drummond McCall & Co., of Winnipeg, gate valves and hydrants, at $8,204; J. H. Ashdown Hardware Co., Ltd., of Winnipeg, 70 tons pig lead, at $99.80 per ton.

St. Thomas, Ont.

The city council has awarded to A. E. Ponsford, 605 Talbot St., the contract for the construction of 4,500 yds. concrete pavement.

Tottenham, Ont.

The following contracts in connection with the waterworks system have been awarded by the municipal council. Water tank, Hunter Bridge & Boiler Co., of Kincardine; water pipes and specials, Page-Hersey Iron, Tube & Lead Co., Ltd., of Toronto; hydrants, Darling Pump & Manufacturing Company, of Williamsport, Pa.; valves, London Foundry Co., of London; laying pipe, E. J. Hartnett, of Toronto; storage basin, Lewis Construction Company, of Toronto.

Waterloo, Ont.

The town council has awarded to Warren Bituminous Paving Company, of Toronto, the contract for the laying of tarvia pavement [illegible] concrete [illegible]ment and bitulithic pavement.

Welland, Ont.

A contract has been awarded by the town council to C. H. Kaumeier, of Port Huron, Ont., for the construction of 60,000 sq. yds. of Metropolitan wire cut lug block pavement.

Railroads, Bridges and Wharves

Berlin, Ont.

Messrs. Bowman & [illegible], engineers, will receive tenders until June 13th, for the construction of [illegible] yds. concrete work in connection with pier and abutments for the "Ayr Bridge."

Bobsaygeon, Ont.

The construction of a lock at this point is contemplated by the Department of Railways & Canals, and tenders will be called shortly.

Brampton, Ont.

The construction of a bridge, on Main St., is proposed by the town council. The town will purchase steel girders, cement, etc., and contract will be let for the work. Engineer, Wm. M. Treadgold.

Calgary, Alta.

Tenders are called for construction of a 4-span concrete and structural steel bridge, 20 ft. wide, carrying one steel railway track. The estimated cost is $90,000. Engineer, Geo. W. Craig.

Dunnville, Ont.

The erection of a station and freight house, at Bridge and Canal Sts., is proposed by the Toronto, Hamilton & Buffalo Rly., the estimated cost of the station is $30,000 and of the freight house, $10,000.

Lamlash, Ont.

Tenders will be received by the reeve, Geo. Brown, Lamlash, R.R. No. 4, Elmwood, until 2 p.m., June 30th, for the erection of a steel bridge over a branch of the Saugeen River, 42 ft. span, roadway 16 ft. wide, concrete floor, also two abutments for same. Plans with the reeve and the engineer, Jas. Warren, Walkerton.

New Liskeard, Ont.

The erection of freight sheds is being considered by the T. & N. O. Rly. The old building is to be removed at once.

Toronto, Ont.

Tenders close with the engineer, Frank Barber, 57 Adelaide E., June 15th, for the construction of a 45-ft. span reinforced concrete truss bridge, Longford limestone abutments, on Scarlett Road (Golf Club Bridge).

Tenders close with the engineer, Frank Barber, 57 Adelaide E., June 22nd, for the construction of a 30-ft. span reinforced concrete truss bridge over Black Creek (Bull's Bridge).

Plans have been prepared and the Board of Control will shortly call tenders for steel work on the Don section of the Bloor street viaduct. The plans for the Rosedale section will be ready in about two weeks.

The tenders for the construction of the Crawford St. bridge were opened on June 4th. They ranged from $31,840 to $19,200 and were referred to the Commissioner of Works, R. C. Harris, for his report.

CONTRACTS AWARDED

Shoal Lake, Man.

The Greater Winnipeg Water District has awarded to [illegible] & [illegible], of Toronto, the contract for the construction of a dyke across Indian Bay to contain about 220,000 cu. yds. of fill.

Public Buildings, Churches, Schools, etc.

Bentinck Twp., Ont.

The school authorities have decided not to proceed with the building of the proposed school this year.

Bienfait, Sask.

Tenders will be received by the trustees of the Bienfait School District No. 897, until 1 p.m. June 30th, for the construction of a brick veneer school 2½ miles north of Bienfait. Plans and specifications are at the offices of H. N. Scott, Estevan, and A. J. Milligan, Bienfait.

Brandon, Man.

Plans and estimates will be prepared for the erection of a new surgical wing to the general hospital, to accommodate 80 beds.

Cocagne, N.B.

The wharf contract has been awarded by the Public Works Department to H. G. Beresford, of 203 Douglas Ave., St. John.

Edmonton, Alta.

Sub-tenders for heating plant in connection with the erection of the Highlands School will be received by the Sec.-treas., Mr. Brady, Mortlake Block, until June 18th.

Ford City, Ont.

The town council is considering calling for competitive plans for the erection of a town hall; estimated cost $35,000.

Goderich, Ont.

The dredging contract has been awarded by the Public Works Department, Secretary, R. C. Desrochers, Ottawa, to Jennings & Ross, Limited, of Toronto.

Halbrite, Sask.

Additions to the school building, at a cost of $6,000, are contemplated by the School Board. Architect, Geo. J. G. Jarrett, Fox Block, Weyburn.

Hamilton, Ont.

Plans have been drawn for alterations to the hospital, at a cost of $100,000. The plans have to be passed by the Hospital Board and the Board of Control.

Hay Township, Ont.

The township council has awarded to Peter Corriveau, of Furich, the contract for the construction of 6 small bridges.

Ingersoll, Ont.

Plans for the erection of an armoury, on Charles St. W., at a cost of $50,000, have been drawn by the Public Works Department, and tenders will be called in the near future.

Joliette, Que.

Plans and specifications for the erection of a public school are at the office of the Sec.-Treas., J. M. Mondor, Baby St., who will receive tenders until 8 p.m. June [illegible]th.

London, Ont.

The Board of Education has abandoned the proposal to erect a school on Adelaide and St. James Sts.

East London, Ont.

The proposal to erect a high school, on Dundas St., has been abandoned by the Board of Education.

Millbrook, Ont.

The [illegible]

[illegible] the building of the public library until next year.

Montreal, Que.

Plans for the erection of a school building on Mt. Royal Ave., for the Protestant Board of School Commrs., are being drawn by Nobbs & Hyde, Old Birks Bldg.

Tenders for the erection of a synagogue, on St. Urbain St., for The Adath Eshroon, will shortly close with the architect, C. Dufort, 192 St. Catherine W.

Montreal, Que., Pt. Aux Trembles

The specifications for the school building for the R. C. School Commrs. have been changed. Tenders will be received by the architect, C. A. Reeves, St. James St., about June 15th.

Moose Jaw, Sask.

The city council has requested the Regina Commrs. to loan them the plans of the proposed Police Station at Regina.

North Battleford, Sask.

Plans for the erection of a public library are being drawn for the city council.

Oshawa, Ont.

Tenders for interior fittings at the post office will be received by R. C. Desrochers, Public Works Department, Ottawa, until 4 p.m. June 15th.

Ottawa, Ont.

Tenders will be received this week by the architect, W. E. Noffke, 405 Plaza Bldg., for the steam heating of Howick Hall.

Port Coquitlam, B. C.

The Pitt River bridge contract has been awarded by the Public Works Department to Armstrong, Morrison & Co., Ltd., of 543 Granville St., Vancouver.

Quebec, Que.

Plans have been drawn for "Wolfe Memorial" Church, on DesBraves Ave., for the St. Matthews Church Congregation. Architect, Ralph A. Cram, 15 Beacon St., Boston, Mass., U.S.

Regina, Sask.

A by-law may be submitted to the ratepayers for authority to give one block for a site for the erection of a Roman Catholic Orphanage. In the event of the by-law carrying, buildings valued at $75,000, are to be erected within five years.

Springhill, N.S.

New tenders for the construction of a rifle range will be received by Director of Contracts, Dept. of Militia & Defence, headquarters, Ottawa, until noon, June 15th. Plans, etc., are at the office of the officer commanding the 6th Divisional Area, Halifax; Town Clerk, Springhill, and the Director General of Engineer Services, Headquarters, Ottawa.

Sydney, N.S.

The city council has voted the sum of $16,000 for the purpose of purchasing site and erecting a fire hall.

Sherbrooke, Que.

Tenders of additions and wing to Queen St. school will be received by the Protestant School Board Secretary, C. O. Palmer, Record Block, until June 13.

Plans for the erection of a new Baptist Church, on Queen St., are being prepared by H. G. James, architect, Whiting Block.

Stratford, Ont.

Sketches for addition to the post office have been drawn for the Public Works Department by J. S. Russell, architect, 21 Downie St.

Toronto, Ont.

Tenders for all trades in connection with the erection of a 21-room school on Niagara street will close with the Board of Education on June 12th.

Tenders close with the Board of Control, June 16th, for repairing and renewing the tile roof of the city hall.

Plans are being prepared for the erection of a club building on Simcoe St., for the Engineers' Club of Toronto. E. G. Bird, of the Bank of Toronto Bldg., is the architect.

Sketch plans for the erection of a church on Danforth and Moscow Aves., for the Roman Catholic Church of the Holy Name are being drawn by the architect, J. A. Thatcher, 31 Queen St. W. Tenders will not be called for some weeks yet.

Plans are being prepared for extensions to St. Nicholas Anglican Church, Birch Cliff, to afford increased accommodation for Sunday School and new Parish Hall.

East Toronto, Ont.

S. B. Coon & Son, of the Ryrie Bldg., have been appointed architects in connection with the erection of a 10-room school for the school section No. 26 York.

Toronto, Ont. (Fairbank)

The contract for school additions has been awarded to E. Birch, Harvie Ave., Toronto, $14,127.

Trenton, Ont.

The erection of a public library is proposed by the town council and the necessary funds are to be raised.

Victoria Harbor, B.C.

Tenders for the construction of a quay wall will be received by R. C. Desrochers, Public Works Department, Ottawa, until July 27th, at 4 p.m. Plans, etc., are at the offices of the district engineers at Victoria, New Westminster, Confederation Life Bldg., Toronto, Ont., and Shaughnessy Bldg., Montreal, Que.

Warner, Alta.

Tenders for the erection of a 6-room school will be received by the Secretary-treasurer, G. W. Morton, Warner. F. H. Palmer, of Lethbridge, is the architect.

The following contracts have been let in connection with the alterations to St. Peters School. Mason, S. Young, 41 Hazelton Ave.; carpentry, T. J. Sullivan, 522 Ontario street; plumbing, Kelly & Cracknell, 21 Foxley street.

Winnipeg, Man. (Charleswood)

Plans are being drawn for the erection of a 4-room school for the St. Charles School District, by E. D. Tuttle, architect, 709 McArthur Bldg., Winnipeg. Tenders will be called in about a month.

The Board of Education has approved of the plans for the erection of a new school building on Niagara street. Tenders will be called for shortly.

Plans are being prepared for the erection of a fire hall at North Toronto, work on which is expected to start this fall.

Winnipeg, Man.

A site on Graham and Ford Sts., has been selected by the Winnipeg Athletic Club, for the erection of club buildings. Pratt & Ross, are the architects, but working plans are not yet started. The estimated cost is $750,000.

Wolfville, N.S.

Plans for students dormitory in connection with the Acadia University have been drawn by Chas. H. McClare, of Cambridge, Mass.

CONTRACTS AWARDED

Edson, Alta.

The contract for the erection of the hospital has been secured by the Edson Construction Company.

Kentville, N.S.

The contract for the erection of the new St. Paul's Presbyterian Church has been awarded to C. H. Wright, of Wolfville.

Montreal, Que.

The contract for extensions to St. James The Apostle Church has been let to C. E. Deakin, Ltd., 41 Mayor St., who will sublet some trades.

Oakville, Ont.

The contract for the I. O. F. orphanage has been awarded to the Sutherland Construction Company of Toronto, who are now open or sub-contracts.

Portage la Prairie, Man.

The nurses' home contract has been awarded by the town council to McCaig & Ellwood. Tender for electric wiring is to be called at once.

St. John, N.B.

The contract for remodelling the Church of England Institute on Princess St., has been secured by A. Dodge, of Sydney St.

Toronto, Ont.

The following contracts have been awarded by the Board of Education; Ryerson Avenue School.—plumbing, J. R. Seager, 799 College street, $1,563.95; heating and ventilating, J. R. Seager, 799 College street, $2,787; wiring, A. R. Rice & Company, 152 Bay St., $287. King Edward School—masonry work for ash hoist, G. T. Gayton, 2 Wayland Ave., $625; ash hoist, Fred Armstrong Co., Queen W., $90. Ord Street—metal sash, Steel & Radiation, Fraser Ave., $1,523.50.

The following additional contracts have been awarded by the Separate School Board: St. Cecilia School, terrazzo floors, Italian Mosaic & Marble Co., College street; electrical work, Martin Nealon, 15 Harbord Street. St. Helens School—terrazzo floors, Italian Mosaic & Marble Co., College street; electrical work, Martin Nealon, 15 Harbord street.

Weyburn, Sask.

The following contracts have been awarded in connection with the erection of a city hall and fire hall. General contractors, Smith Bros. & Wilson, of

Regina; heating, Geo. T. Walker, 3rd St., Weyburn.

Business Buildings and Industrial Plants

Axe Lake, Ont.

The Muskoka Wood Mfg. Co., of Huntsville, propose to rebuild the saw-mill destroyed by fire May 17th. It is expected to be in operation by November 1st.

Brampton, Ont.

A by-law has been passed whereby the town guarantees the bonds of Lindner's, Ltd., to the extent of $20,000. The company will build a plant to manufacture jams, pickles, etc.

The bonds of The Imperial Iron & Steel Co. have also been guaranteed for a like amount, and a plant will be erected.

A by-law has been passed granting to the Copeland-Chatterson Co., exemption from taxes for 15 years. The company will make additions to their plant at a cost of $50,000.

Calgary, Alta.

The contract for the construction of the grain elevator has been awarded by the Public Works Department, to James Bros., 1 Mackie Block. The capacity is 2,500,000 bushels.

Edmonton, Alta.

A permit for the erection of a warehouse, on 4th St., has been granted to Metals, Limited.

Galt, Ont.

A by-law authorizing a loan of $12,000 to the Maple Leaf Bedding Co., has been passed by the ratepayers.

Hamilton, Ont.

It is understood that nothing further will be done this year in regard to the addition to the National Steel Car Company's plant.

Listowel, Ont.

Libby, McNeil & Libby, of Chicago, Ill., are negotiating with council with a view to obtaining interswitching facilities between the G. T. R. and the C. P. R. The company will probably erect a condensed milk factory.

The by-law granting a loan of $10,000 to the Dominion Milk Flour Mfg. Co., has been withdrawn.

London, Ont.

The Crucible Metal Company propose to erect a factory at a cost of $50,000.

Montreal, Que.

Plans for the erection of a $50,000 theatre, on Montcalm St. and St. Catherine St. E., for Messrs. Bastien & Back, are to be prepared by C. Dufort, 192 St. Catherine W.

Plans for a $1,000,000 factory building have been drawn by Henry Morgan & Co., Ltd. The building will probably be erected this year.

Plans have been drawn for alterations to the store of R. & F. Prefontaine, on St. Lawrence and Prince Arthur. Tenders will be called in due course.

The erection of an office building, on Bleury St., by a private syndicate, in which Mr. Jas. Walder, of 11 Mayor St. is interested, has been postponed until next year.

Ottawa, Ont.

The erection of a theatre and stores on Armstrong St., at a cost of $14,000, is proposed by Wilson & Petrogorsky, 256 Kent St.

Port Alberni, B.C.

Evans & Cook, 236 Rogers Bldg., Vancouver, are preparing plans for the erection of a hotel for Mr. T. Magrath.

Red Deer, Alta.

Tenders will be called shortly for addition to the business block of G. W. Greene, 3rd St. N.

Rock Island, Que.

Chas. L. Chamberlain, of Slater Bldg., Worcester, Mass., has been appointed architect in connection with the erection of a machine shop for the Union Twist & Drill Co.

Toronto, Ont.

Bulk tenders for the erection of 2 stores and apartments, on Queen St., near High Park, are invited by Equitable Securities of Canada, Ltd., 1023 Traders Bank Bldg.

Plans have been drawn for the erection of 2 stores and apartments, on Yonge St., at a cost of $14,000. Tenders will be received by P. H. Love, 2369 Yonge St., until June 12th, for drainage and concreting, roofing, plastering, painting, heating, plumbing and electrical.

Tenders for the erection of a garage, on Yonge St., near DeLisle St., are invited by the architect, L. Foulds, King and Leader Lane; estimated cost $28,000.

Tenders for interior work at King's Cafe are invited by R. J. Dodds, 14 King E.

Plans for the erection of 7 attached stores and residences, on Roncesvalles Ave., at a cost of $30,000, have been drawn for H. R. Reynolds, by E. R. Conlan, 73 Grenadier Rd. The owner will superintend construction.

Vancouver, B.C.

The contract for the erection of a store on Main street has been awarded by L. R. Lurie to J. J. Frantz Construction Company, Arts & Crafts Building.

The contract for the erection of a shingle mill at Burnaby Lake for Councillor P. W. FauVel, has been let to T. P. Morrison, of Burnaby. The mill is to have a daily capacity of 100,000 shingles.

Welland, Ont.

Plans for remodelling and rebuilding the Opera House Block are being drawn by J. L. Nichols, 18 Main St. S.

Winnipeg, Man.

A permit for the erection of a store on Portage Ave., at a cost of $5,000, has been granted to W. A. Bartram, 114 Sherbrooke St.

The proposed additions to Burroughs, Stewart & Milne Co.'s warehouse, James St. E., will not be proceeded with this year.

A permit for the erection of a steel metal product factory at a cost of $8,500 has been issued to Oribo Manufacturing Company, [illegible] Spadina Ave.

CONTRACTS AWARDED

Edmonton, Alta.

The contract for the erection of store and apartments for A. C. Rutherford has been secured by Jas. Watson & Co., of 146 Whyte Ave.

Guelph, Ont.

The contract for the erection of a factory for the Kawneer Mfg. Co., Ltd., of Niles, Mich., and Toronto, has been let to Gutleben Bros.

Montreal, Que., Cote de Neiges

The contract for the erection of Molsons Bank has been let to Laurentian Constr. Co., 103 St. Francois Xavier St.

Preston, Ont.

The following contracts have been awarded in connection with the erection of a business block, on King St. Masonry, Samuel Braund; carpentry, Rich. Kroes.

Regina, Sask.

The following sub-contracts have been awarded on the erection of a theatre on Rose, for D. M. Hackeny. Heating, plumbing and electrical, Potts & Smith, 1841 Cornwall St.; interior fittings, Western Mfg. Co., Regina.

St. Thomas, Ont.

The contract for the erection of a bank and office building, on Talbot St., for the Royal Bank of Canada, has been secured by Purdy & Henderson, of 211 McGill St., Montreal.

Toronto, Ont.

The contract for addition to the Gutta Percha & Rubber Co.'s factory, on O'Hara Ave., has been awarded to Jennings & Ross, 79 Spadina Ave.

Waterloo, Ont.

The Bank of Commerce contract has been secured by Sutherland Constr. Co., Ryrie Bldg., Toronto, who are now open for sub-contracts.

West Lorne, Ont.

The contract for remodelling the local branch of the Merchants Bank of Canada, has been secured by Mr. Young, 240 Birmingham, Stratford.

Winnipeg, Man.

The contract for alterations to the Bank of British North America, Main St., has been let to Hazelton & Walin, Donalda Block.

Residences

Hamilton, Ont.

New tenders for the erection of a $100,000 apartment house at the corner of Bay and Herkimer streets are invited by the architects, Stewart & Witton, 7 Hughson Street South.

Tenders for roofing, heating and plumbing on the erection of an apartment house on St. Matthews Ave. for R. J. Press & Son, are invited by the architects, Hines & Vokes, 206 Hughson St. N., until June 18th.

Hamilton, Ont. (Dundas)

Plans for the erection of a residence on Colborne street for H. E. Tallman, are being drawn by E. Greenwoods, of Dundas.

D. M. Campbell, contractor, of 124 Robinson street, Hamilton, proposes to

(Continued on page 84)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Supplying Coal for the Dominion Buildings," will be received at this office until 4 p.m. on **Monday, July 6, 1914**, for the supply of coal for the Public Buildings throughout the Dominion.

Combined specification and form of tender can be obtained on application at this office and from the caretakers of the different Dominion Buildings.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the contract. If the tender be not accepted the cheque will be returned.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 2, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—62371 23-24

Sealed tenders addressed to the undersigned, and endorsed "Tender for Renewal of present Wharf and Extension to same at Brighton, Ont.," will be received at this office until 4.00 p.m. on **Wednesday, June 24, 1914**, for the renewal of existing Wharf and the construction of an extension to same at the Village of Brighton, Northumberland County, Ont.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Brighton, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, May 26, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51207 22-23

Tenders for

Street Pavements

City of Sault Ste. Marie, Ont.

Sealed tenders fully endorsed and marked "Tender for Street Pavements," addressed to T. E. Simpson, Mayor, Sault Ste. Marie, Ontario, will be received by the City Clerk up to five o'clock p.m. on **Monday, June 15th, 1914**, for the construction of about

12,000 square yards Concrete Pavement.

1,800 square yards Vitrified Brick Pavement.

20,000 square yards Asphaltic Concrete or Bitulithic Pavement.

5,000 square yards Dolarway or Pavement with similar Top Dressing.

1,400 square yards Hard Stone Blocks or Hillside Vitrified Brick Pavement.

Specifications and plans may be seen and all information and forms of tender obtained at the office of the City Engineer, Sault Ste. Marie, Ont.

A marked cheque payable to the order of the City Treasurer must accompany each tender and a bond or a cash deposit will be required of the successful bidder all as outlined in the tender form.

The lowest or any tender not necessarily accepted.

C. J. PIM,
23 City Clerk.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Revetment Wall at Burlington, Ont.," will be received at this office until 4 p.m. on **Monday, July 6, 1914**, for the construction of a Revetment Wall at the Town of Burlington, Halton County, Ont.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Burlington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 4, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—62564. 23-24

CITY OF CALGARY

Sealed tenders marked "Tenders for Water Meters," addressed to the City Commissioners, will be received at the office of the undersigned up to one o'clock p.m. on **Wednesday, June 24th, 1914**, for the supply and delivery, F.O.B. duty paid, at Calgary the following water meters, more or less:—

100 1-in. meters.
50 ¾-in. meters.
20 2-in. meters.

Positive, frost proof case or bottom.

A marked cheque equivalent to 5 per cent. of the total amount of the contract and payable to the city of Calgary must accompany each tender, cheques will be returned to unsuccessful tenderers as soon as the contract has been executed.

The City reserves the right to accept or reject any or all tenders, in whole or in part, or to accept any bid or portion thereof as may be advantageous and to the satisfaction of the City.

For further information and copy of specifications apply at the office of the Waterworks Engineer, City Hall, Calgary, Alberta.

J. M. MILLER,
23 City Clerk.

Notice to Bidders

Sealed proposals endorsed "Proposal for Painting Highway Bridge," addressed to H. Baker, City Clerk, will be received at the City Hall, Medicine Hat, Alberta, until twelve (12) o'clock **June 15th, 1914.**

Proposals must be made upon the form for the purpose, and must be accompanied by a certified cheque for ten per cent. (10 p.c.) of the amount of such proposal made payable to the Corporation of the City of Medicine Hat. Cheques will be returned to unsuccessful bidders within three days (not including Sundays) after the award of contract. An acceptable bond will be required for the faithful performance of the work in a sum of twenty-five (25) per cent. of the total amount of the bid.

Proposal forms and specifications may be obtained from, and plans of the structure may be inspected at the office of the City Engineer, Medicine Hat.

The City reserves the right to reject any or all bids.

H. BAKER, City Clerk.

City Hall, Medicine Hat,
May 23rd, 1914. 22-23

Tenders for Steelwork

Sealed tenders addressed to J. B. Cote, Secretary, and marked "Tenders for Provencher Bridge," will be received up to 12 o'clock noon, **Saturday, the 20th day of June**, for supply and erection of the superstructure for the Provencher Avenue Bridge over the Red River between St. Boniface and Winnipeg.

Plans and specifications may be seen and forms of tender obtained at the offices of:—

The City Engineer, St. Boniface, Man.
The City Engineer, Winnipeg, Man.
Contract Record, Toronto, Ont.

Canadian Engineer, Montreal, Que.
Pittsburg Testing Laboratories, Pittsburg.
Engineering News, New York.
Strauss Bascule Bridge Co., Chicago.

All tenders to be accompanied by a marked cheque or bid bond for $10,000.

The lowest or any tender not necessarily accepted.

J. B. COTE, Secretary,

19-23 City Hall, St. Boniface, Man.

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 15, 1914**, for the construction of concrete sidewalks on:—1. Baby Point Road and Talbot Place; 2. Warren Road; 3. Earnscliffe Road, in Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide St. E., Toronto. The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, June 6, 1914. 23

TOWN OF ST. LAMBERT

Concrete Sidewalks

Sealed tenders will be received up to 6 p.m., **June 15th, 1914**, for the laying of about 25,000 to 30,000 lineal feet of Concrete Sidewalk and Curb, and sidewalk curb and gutter.

Plans may be seen and specification and form of tender may be had at the office of the undersigned on and after the 5th inst.

Hot Concrete Mixer

Sealed tenders will be received up to 6 p.m. **June 22nd, 1914**, for the supplying of Hot Bituminous Concrete Mixer. Specifications may be had on and after the 5th inst.

(Signed) E. DRINKWATER,
23 Town Engineer.

Sealed tenders addressed to the undersigned and endorsed "Tender for Quay Wall and Excavation at Victoria Harbour, B.C.," will be received at this office until 4 p.m. on **Monday, July 27, 1914**, for the construction of a Quay Wall and Excavation at Victoria Harbour, B.C.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers at Victoria, B.C.; New Westminster, B.C.; Confederation Life Building, Toronto, Ont., and Shaughnessy Building, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at this Department by depositing an accepted bank cheque for the sum of $25.00 made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June [illegible], 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—[illegible]

Tenders for Construction of Pavement

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 15, 1914**, for the construction of Asphaltic Pavement on Warren Road, in Township of York.

Plans and specifications and all necessary information may be obtained at the office of the undersigned, 57 Adelaide St. E., Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, June 6, 1914. 23

Tenders for Bridge

Tenders will be received by the undersigned till **Tuesday 30th inst.**, at 2 p.m., at Lamlash (at which time the tenders will be opened) for the erection of a steel bridge over a branch of the Saugeen River. Span 42 feet, roadway 16 ft. wide, with concrete floor. Also for two abutments for the same. Plans and specifications may be seen with James Warren, Engineer, Walkerton, or with the undersigned. A certified cheque for $100, payable to the Reeve of Township of Bentinck, must accompany each tender.

The lowest or any tender not necessarily accepted.

GEORGE BROWN, Reeve.
Lamlash, (R.R. No. 4 Elmwood)
June 3rd, 1914 23-24

Bridge Tenders

Sealed tenders will be received by Mr. E. G. Boyd, Damascus, Ontario, up to **June 15th** for the construction of the following bridges for the County of Wellington.

(a) 60 ft. concrete truss or 62 ft. steel bridge and concrete abutments for Mallett Bridge.

(b) 40 ft. Concrete Truss for Sinclair's Bridge.

(c) 25 ft. Arch for Saigeon Bridge.

(d) 12 ft. Concrete Slab Bridge.

(e) Concrete abutments for O'Dwyers Bridge.

For plans and other information apply to

BOWMAN & CONNOR, Engineers,
23 16 King St. West, Toronto.

TOWNSHIP OF BRANTFORD

Concrete Sidewalks

Sealed tenders addressed to the Township Clerk, County Building, Brantford, will be received up to 6 p.m. on **Wednesday, the 10th of June, 1914**, for the construction of 38,124 linear feet (7¼ miles) of four foot concrete sidewalks.

The work will be let in two separate contracts as follows:

No. 1 Group comprising 30,243 lin. ft., being composed of all walks north of Grand River Canal.

No. 2 Group comprising 7,881 lin. ft., being composed of all walks south of Grand River Canal.

Tenders must be accompanied by a marked cheque for [illegible] of the amount of the tender made payable to the Township Treasurer.

Tenderers are expected to examine the locality before tendering. Plans, specifications and information to tenderers may be seen at the office of the Township Engineer, [illegible] 4 [illegible] Building, Brantford, where tender forms may be obtained.

The Council does not bind itself to accept the lowest or any tender.

[illegible],
[illegible] Township Engineer.

Tenders for Construction of Sewers

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, June 15, 1914**, for the construction of Sewers on Day and Sellers Avenues in Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide St. E., Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, June 6, 1914. 23

Tenders for

CEMENT WALKS

Town of Perth, Ontario

Sealed tenders marked "Tender for Cement Walks," addressed to Jno. A. Kerr, Town Clerk, will be received up to noon, **Thursday, June 18, 1914**, for the construction of approximately 30,000 square feet Concrete Sidewalks in the town of Perth. Plans and specifications may be obtained at the office of the Town Engineer. A marked cheque for the sum of Two Hundred Dollars payable to the order of the Treasurer of the Town of Perth must accompany each tender. A bond in the sum of $1,000 or in lieu thereof a cash deposit of $600 will be required of the successful bidder.

The lowest or any tender not necessarily accepted.

J. H. MOORE, Town Engineer,
Smiths Falls, Ont.

JNO. A. KERR, Town Clerk,
23 Perth, Ont.

Tenders for the Construction of the Concrete Abutments, Retaining Walls, and Bridge Floor for the Strachan Ave. Bridge over the Grand Trunk Railway Tracks

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, July 7th, 1914**, as follows:

For the construction of the concrete abutments, retaining walls, and bridge floor for the Strachan Avenue Bridge over the Grand Trunk Railway [illegible].

[illegible] specifications and forms of tender may be obtained upon application at the office of the Railway and Bridge Section, Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal. Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof the bond of a guarantee company approved as aforesaid. [illegible]

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto, June [illegible], 1914. [illegible]

Tenders Wanted

Sealed tenders marked "Tender for Water works" will be received by the undersigned until June 17th 1914 at 5 p.m. for the supply and laying of [illegible] hydrants, valves, etc., for the Town of LaSalle, P.Q.

Plans and specifications may be seen and tender forms obtained at the office of the engineer, [illegible] 225 St. James Street, Montreal, or at the Secretary's office in the Town Hall, on Strathyre Avenue, LaSalle, P.Q.

Each tender must be accompanied by an accepted bank cheque to the amount of 5 per cent [illegible].

The lowest or any tender not necessarily accepted.

[illegible] LAFLEUR,
Secretary Treasurer
[illegible] Post Office,
[illegible] P.Q. 23

WANTED

[illegible] agent to handle entire line of a large electrical manufacturer of power house specialties, on a commission basis. Address, with full particulars to Box 34, Electrical News, Toronto. 22-23

Wanted to Purchase

One second hand stiff leg derrick, one ton capacity, with or without cables.

One Ideal and one Singer cement block machines with pallets.

Mrs. F. W. HOARE,
23-24 St. Catharines, Ont.

FOR SALE—At Hamilton Beach—95 tons of second-hand 14-in. Lackawanna Steel Sheet Piling in eighteen foot lengths. Price fifteen dollars per ton F.O.B. Hamilton. John W. Danforth Company, Buffalo, N.Y. 23

For Sale—Cheap

1 Pony Planer, McGregor & Gourley, 24-in., in good running condition.

1 Iron Saw Table, 3 ft. x 5 ft., Ballantyne Tilting Guide.

Box 27, Contract Record & Engineering Review, Toronto. 21-23

Second Hand Contracting Plant For Sale

One 45-ton Marion Steam Shovel.

Two Canadian Rand Drills, one Overhead Cable Gear complete with Boiler and Engine, Trolley Cars and Quarry Skips (in use only a few months).

One Donkey Engine, Etc.

Prices and further particulars on application.

F. A. RONNAN & CO.,
23-24 Halifax, N.S.

Residences

(Continued from page 81)

erect a row of houses on the new survey in Dundas and West Flamboro.

Medicine Hat, Alta.
The Saskatchewan Bridge & Iron Works Company of Moose Jaw, will shortly start on 25 workmen's residences.

Montreal, Que.
The erection of the $40,000 apartment house on Lasalle street proposed by Mr. DesLauriers, has been postponed until the fall.

Tenders for the erection of a residence on Bruce and Dorchester streets are invited by the architects, Saxe and Archibald, 49 Beaver Hall Hill.

Montreal, Que. (Outremont)
Plans for the erection of a $13,000 residence for Dr. Gareeau, on Ainslie street, have been drawn by Jos. Surveyer.

S. Frappier, 2238 Park Ave., has drawn plans for the erection of a residence on Stewart street for H. Paladeau.

Plans for the erection of an apartment block on Bloomfield street have been drawn for J. A. Prevost, 1455 Gouin Blvd. Estimated cost $50,000.

Plans for the erection of an apartment house onBernard street for A. Guenette are being prepared by C. A. Reeves, 58 St. James street. Estimated cost $30,000.

Montreal, Que. (St. Laurent)
Tenders for the erection of a residence for H. E. Trudeau will be called shortly by the architect, G. A. Monette, 706-83 raig St. W.

Montreal, Que. (Westmount)
Plans for the erection of a residence on Avenue Road for C. N. Robertson, have been drawn by Hutchison, Wood & Miller, Royal Insurance Bldg.

Tenders for the erection of a residence on Bruce and Dorchester streets are invited by the architects, Saxe & Archibald, 49 Beaver Hall Hill, until June 20.

Niagara Falls, Ont.
The plans for the erection of a residence on Burn Street for Kenneth Anderson have been revised. The contract is not yet let.

Nut Lake Reserve, Sask.
Tenders will be received by Duncan Scott, Dept. of Indian Affairs, Ottawa, until noon, June 22nd, for the erection of a farmer's residence at Nut Lake Indian Reserve. Plans and specifications at the post offices Wadena and Kinistino, Dominion Land Offices, Prince Albert and Melfort, the office of the Indian Agent, Duck Lake, Sask, and at the Department, Ottawa.

Orillia, Ont.
Geo. H. Clark has decided to postpone the erection of a residence as the tenders received were too high.

Regina, Sask.
A permit for the erection of a residence on St. John Street at a cost of $5,000, has been granted to H. Black, 17 New Black Block.

Toronto, Ont.
Tenders for the erection of a residence on Spadina Road are invited by the architects, Dennison & Stephenson, 18 King St. W., until June 13th.

A. H. Cassavoy, 200 Howard Park Ave., has purchased a site on Alhambra Ave. and will erect a $7,000 residence thereon.

P. E. Carmichael, 450 Indian Road, has purchased a site on High Park Boulevard and proposes to erect a residence this year.

Plans for the erection of a detached residence on Glenholme Ave. have been drawn for E. W. Goulding, 106 Victoria Street, who will buy all the material.

Plans are being prepared for the erection of a rectory in connection with the Roman Catholic Church of the Holy Name. J. A. Thatcher, 31 Queen St. W., is the architect.

Windsor, Ont.
New tenders on the erection of a residence on Victoria street for W. R. Bonds are invited by the architect, J. C. Pennington, LaBelle Bldg., June 15th.

Winnipeg, Man.
Recent permits include: Hancox Land and Building Co., 8 residences on Teller street, at $5,000 each; E. Russell, 890 Ida street, $10,000; P. S. Wright, 12 Harrow Apts., residence on Yale Ave., $10,000; W. P. Wallace, 6 Lincoln Apts., 2 residences on Kingsway, $24,000; R. C. Mitchell, 612 Florence Ave., 2 residences on Ashplant Ave., $8,500.

CONTRACTS AWARDED

Hamilton, Ont.
The following contracts have been awarded in connection with the erection of a residence on Barnesdale street for Dr. Emory: general contract, carpentry, painting, electrical, James Bryers, 36 Gibson street; masonry, John Bryers, 724 Cannon Street East; heating and plumbing, Jas. Saynor, 173 John street.

Hamilton, Ont.
The following contracts have been awarded in connection with the erection of a residence on Barnesdale street for J. B. McTaggart: general contract and carpentry, T. W. Reid, 98 Eastbourne street; masonry, Smith Bros., 270 Cannon St. E.; plastering, J. Mowitt, 194 Maple Ave.; painting, C. Keine Beach; heating and plumbing, A. Beare, 12 Wentworth St. S.; electrical, W. Little, Grove St.

Montreal West, Que.
The contract for the erection of a residence for H. L. Trotter has been let to J. J. Kirkpatrick, 5 Fenwick Ave., Montreal West.

Ottawa, Ont.
The following contracts have been awarded on the erection of an apartment block on Nelson street for Louis Green: masonry, I. B. Younghusband, 6 Spruce; carpentry, R. E. McKinstry, 91 2nd Ave.; plastering, painting, heating and plumbing not let.

Sherbrooke, Que.
The contract for the erection of a residence on Victoria street for Jno. MacDonald has been secured by J. W. Clark & Co., Longueiul.

Stanstead, Que.
The contract for the erection of a residence on Caswell Ave. for W. H. McDowell has been let to Ls. H. Huckins.

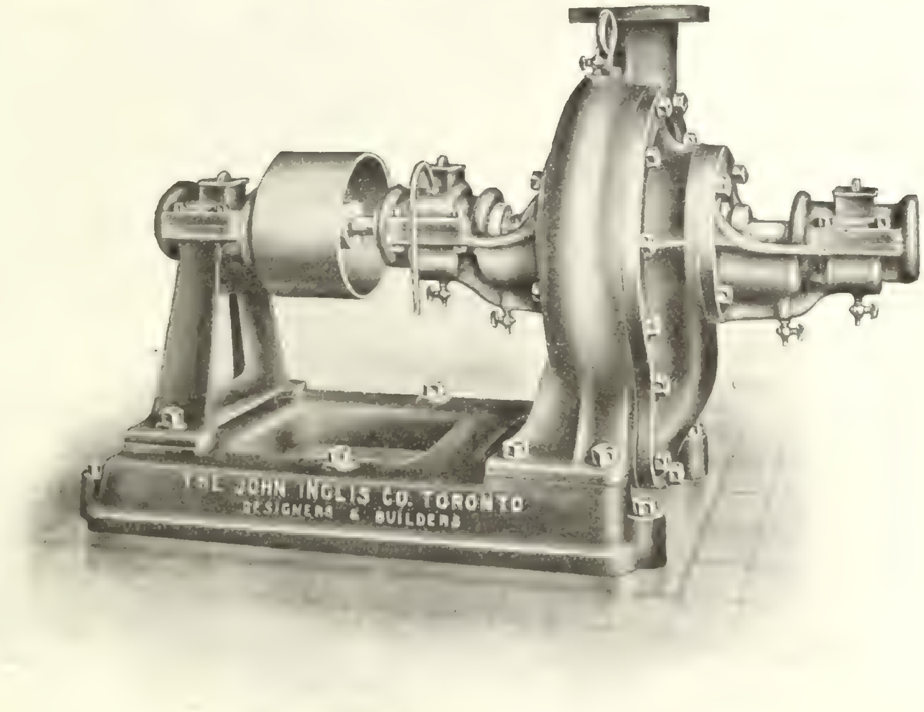
Wolfville, N.S.
The contract for the erection of a residence for Robie Tufts has been let to C. H. Wright.

Power Plants, Electricity and Telephones

Edson, Alta.
The installation of an electric light and power system at a cost of $45,000 is proposed by the town council. The necessary debentures have been passed.

Edmonton, Alta.
Tenders for the supply of fire apparatus will be received by the city commission-

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

[illegible] until June 18th, for (1) one motor [illegible] chemical and hose wagon with [illegible] chemical tank, 1,200 ft. capacity hose bed with divisional body and full equipment; (2) motor combination [illegible] and hose pumping capacity of about [illegible] gallons per min., hose bed to carry 1,000 ft. 2½-in. standard hose with division body, 1 motor city service hook and ladder truck with 50 ft. extension, with two 12 ft. pempier ladders, full equipment, 5,000 ft. 2½-in. cotton, rubber-lined hose, 8 only play pipes; 2 brass 2½-in. sliding poles each 30 ft. long; 4 landing pads; 6 only life belts with hatchets; 2 doz. hose ladder strap [illegible] information, etc., at office of the Fire Chief, Station No. 1.

Kincardine, Ont.

The ratepayers will be asked to vote on by-law June 25th to raise the sum of $3,500 for the purpose of changing the street lighting from the arc to the incandescent system.

Medicine Hat, Alta.

Estimates are being prepared by the city council with a view to constructing an electric power line along Ansley Spur to the West Industrial site, a distance of 3½ miles, to handle products and supplies from the various factories.

Toronto, Ont.

The Toronto & York Radial Company are about to put in four additional switches and expect to purchase eight new cars for the Metropolitan division of their system.

Winnipeg, Man.

Tenders will be received by the Board of Control until June 23rd for the supply of approximately 16,000 ft. lead covered paper and rubber insulated low tension cable. Specifications are at the office of the engineer, J. G. Glassco, 54 King St.

Wolseley, Sask.

Extensions to electric lighting system are about to be made by the town council. Permission has been granted by the provincial government to raise the sum [illegible]

CONTRACTS AWARDED

Brampton, Ont.

The contract for the installation of an electrical fire alarm system has been awarded by the town council to the Northern Electric Company of Toronto.

Regina, Sask.

The following contracts for street railway material have been awarded by the city council: (a) United States Steel Products Company, Winnipeg, for 100 tons 7-in. steel tee rails and specials at $4,125.37; (b) Canada Cement Company, Winnipeg, 9,000 bbls. Portland cement at $25,695; (c) Northern Electric & Manufacturing Company, of Winnipeg, 2 miles trolley wire at $326.60; (d) Ohio Brass Company, trolley wire and fixtures at $696.05; general Railway Signal Company, of Winnipeg, 3 half interlocking plants at $4,929.25.

Toronto, Ont.

A contract has been awarded by the Board of Control to the Dyer Fence Company, 645 King St. E., for the construction of a fence dividing the deer paddocks in High Park.

Miscellaneous

Estevan, Sask.

Tenders will be received by the Secretary-treasurer, H. N. Scott, Box 400 P.O., until noon, June 27th, for fencing the Collegiate grounds.

Montreal, Que. (St. Lambert)

Specifications of hot bituminous concrete mixer are at the office of the engineer, E. Drinkwater, who will receive tenders until 6 p.m., June 22nd.

Ottawa, Ont.

The city council is about to purchase one small and one large concrete mixer.

Toronto, Ont.

Tenders close with the board of control until June 23 for work connected with raising houses on Kenilworth Ave. in connection with street grading.

McKinnon & Hyslop, Room 111, 79 Adelaide St. E., are about to purchase: 1 cu. yd. concrete mixer without power; 1-cu. yd. bottom dump concrete buckets; 1 cu. yd. clam with 50-ft. boom, stiff-leg derrick and hoist; 1 20-ton capacity Guy derrick or fittings with hoist and independent swinger; boilers 30 and 60 h.p.; also 2 scows of 400 ton capacity.

Wolfville, N.S.

The Acadia University authorities are about to purchase a chemical engine and outfit and to install a sprinkler system. It is also proposed to construct fire escapes.

Business Notes

Aylmer, Que.

The planing mills of T. Ritchie, Ltd., were recently destroyed by fire. The loss is estimated at $20,000 buildings, $60,000 lumber; insurance to the extent of $50,000 was in force.

Brantford, Ont.

The factory of the Canada Glue Company has been destroyed by fire. The building was of cement construction and will be rebuilt. Loss, $150,000; insurance, $110,000.

Hagersville, Ont.

The mill and bakery of R. J. Rank has been destroyed by fire. The loss, etsimated at $25,000, was covered by insurance.

Hamilton, Ont.

The Wood Milling Company milling plant has been destroyed by fire.

Ingersoll, Ont.

A fire at the premises of the City Flour Mill has inflicted a loss of about $25,000, the machinery being badly damaged.

L'Assomption, Que.

The College de L'Assomption has suffered loss by fire to the extent of $22,000.

Montreal, Que.

A recent fire at the grain storage and flats occupied by W. H. Dwyer, 146 Ottawa Street inflicted a loss of $10,000.

A recent fire destroyed the factory of the Montreal Cotton & Woolen Waste Company, Ottawa and Dalhousie streets. The loss of $25,000 was partially covered by insurance.

Nanaimo, B.C.

The mine building of the Pacific Coast Coal Company has been destroyed by fire. The loss is estimated at $30,000. The company will rebuild.

New Westminster, B.C.

The mill of the Royal City Lumber & Shingle Company, Columbia street, has been burnt. The loss is put at $15,000. The premises will be rebuilt.

Orillia, Ont.

S. E. Carss & Company's lumber mill was recently destroyed by fire. The loss of $100,000, was partially covered by insurance.

Ottawa, Ont.

The planing mill of J. & C. Low, contractors, 262 Catharine St., has been destroyed by fire. $10,000 worth of electrically driven machinery was destroyed.

Strathroy, Ont.

The East End Stave Mills have been destroyed by fire. The loss of $10,000 was covered by insurance.

Westboro, Ont.

The storehouse of F. A. Henry, Richmond Road, has been destroyed by fire. The question of rebuilding is not yet decided upon.

Wolfville, N.S.

The Acadia College residence and gymnasium has been destroyed by fire. The loss is estimated at $15,000. The premises will be rebuilt.

New Companies

The Union Cement Company, Limited, has been incorporated with a capital of $200,000, with head office at Owen Sound, Ont. The provisional directors are T. L. Dates, A. L. Randall, J. McDonald, J. N. Robinson and M. Smith, all of Owen Sound.

The Great Lakes and Atlantic Canal and Power Company, Limited, has been incorporated with a capital of $250,000, with head office at Montreal. The provisional directors are E. A. D. Morgan, G. A. Morrison, H. S. Caron, C. A. Hetu and L. J. Lefebvre, all of Montreal.

The Dominion Clay Products Company, Limited, has been incorporated with a capital of $350,000, with head office at Toronto. The provisional directors are A. W. Wright, W. C. Bonnell, J. J. Beck, J. A. Courtice and Capt. R. M. Melville.

The W. E. Dyer Company, Limited, has been incorporated with a capital of $250,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are D. Henderson, W. H. McGuire, G. F. Rooney and N. Philips.

"If I had only known of that job in time I would have had a good chance for it." Ever heard a contractor make this remark, or has the experience been yours? Provide against this by using MacLean Daily Reports.

Rates and samples on request.

MacLean Daily Reports, Ltd.
220 King St. West, Toronto

Eden Smith & Son,
Architects

Toronto Housing Co., Spruce St.

Hill & Strathy,
Contractors

1,250,000 Sun-Tex Brick were used for eight of these buildings.

SUN-TEX
Clay Products

are absolutely uniform in size, color and texture and possess unequalled wearing powers.

Architects and Contractors who wish to obtain the best results should specify Sun-Tex Clay Products.

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Architects

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Contractors

2,000,000 Sun-Tex Brick were used in the construction of the dwellings illustrated.

Let us furnish you with quotations.

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Traders Bank Building - - - - TORONTO

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Lead Flange Goods

MADE IN CANADA

YOU will never regret the adoption of Mueller Lead Flange Goods—no waterworks man ever has—you will be no exception to this rule.

Mueller Lead Flange goods represent more than the mere making and marketing of the goods—they represent a fixed purpose to make them BETTER, and to give you a dollar's worth of value for every dollar you pay for them.

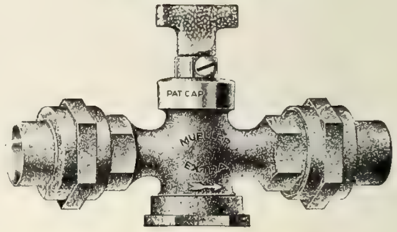
They MUST satisfy you and they MUST uphold our reputation as producers of high-grade Brass goods.

Some of the biggest users in the Dominion have pinned their faith to Mueller Lead Flange Goods and if you will ask them they will tell you what these goods are. But you don't have to ask them—the goods speak for themselves as to quality, material, workmanship and service.

We make Lead Flange Goods in all patterns of Corporation and Curb Cocks, in Goose Necks, etc.

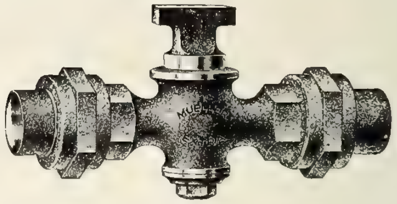
Clip and mail the coupon.
Do it right now. Don't forget it.

Mueller Inverted Key Pat. Cap Lead Flange Curb Cock



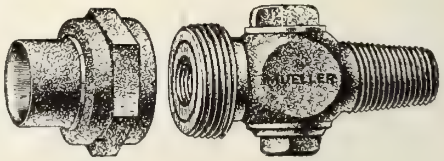
D 5353

Mueller Solid Handle Lead Flange Curb Cock



D 5303

Mueller Lead Flange Corporation Cock



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City __________ P ov. __________

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Enamel Concrete Brick

Our factory is specially designed to produce enamel concrete brick of the highest quality. 3,200,000 pounds of pressure is exerted on every eight brick in the process of manufacture. Think of the meaning of this statement in connection with the permanency and durability of the product.

The National Builders' Supply & Enamel Concrete Brick Co., Limited
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High Calcium Lime

Manufactured by

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SHERBROOKE, - - PROVINCE OF QUEBEC

Its Special advantages are:

Strength,
Whiteness,
Purity

Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

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Would it not be logical to buy from those makers whose experience in heavy haulage and its requirements is not alone confined to their few seasons of motor truck building but also to decades of building expense in heavy duty vehicles which preceded the motor truck?

Tiffin experience combines the successfully solved problems attending the building of Farm and Dump Wagons, Municipal Carts, Street Sprinklers and Flushers and kindred lines.

It is because of our well founded knowledge of heavy delivery in all its phases that we have built TIFFIN MOTOR TRUCKS so well. These Tiffin Trucks will stand greater abuse in operation and overload than any others of their rated capacity. Better investigate today.

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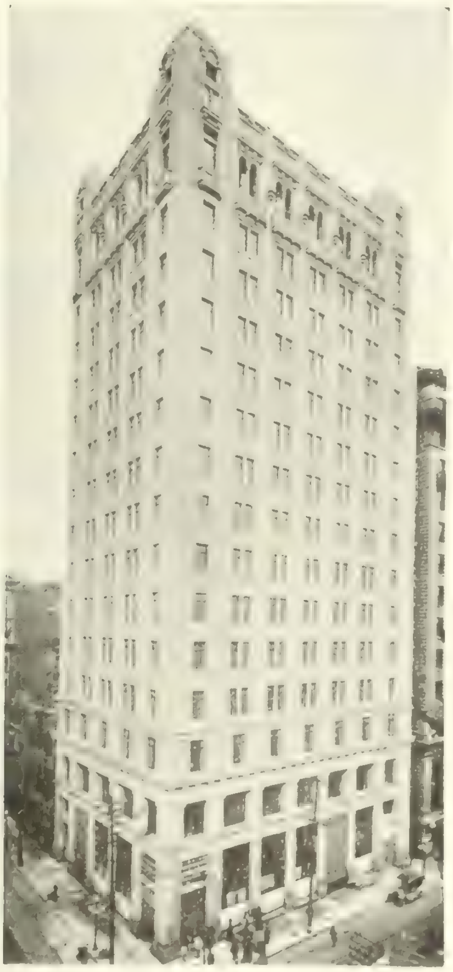
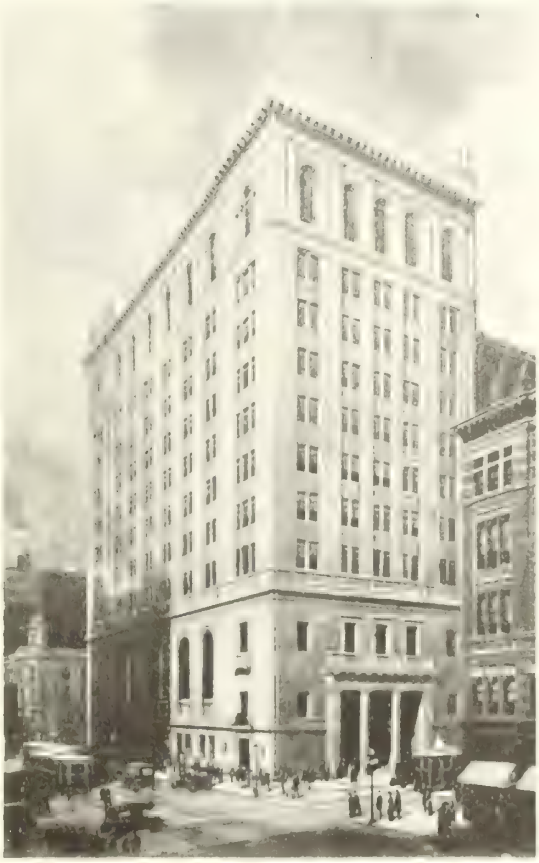
AGENTS: Francis Hankin & Co., Montreal, Toronto and Vancouver
Jas. Bisset & Co., Edmonton, Alta.

THE NORTHWESTERN TERRA COTTA COMPANY



C. P. R. OFFICE BUILDING
Darling & Pierson, Architects



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Darling & Pierson, Architect

Two prominent corners in Toronto

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Rubber Covered
Wires AND Cables

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**The Canadian Bridge
Company, Limited**
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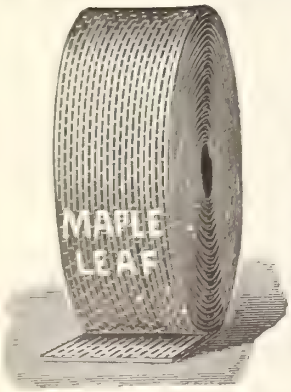
The reason is not hard to find, for there is no part of your Belting system, from the main drive to the smallest light Belt for power transmission, where you will not get the best kinds of service from



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Stitched Cotton Duck
Belting.**

It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

It is built of plies of selected duck.

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DOMINION BELTING CO., LTD.
Hamilton, Canada

McGregor & McIntyre
Limited
Toronto, Canada

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Main Structural Shop: 130 ft. x 400 ft.
Area of Grounds: Ten Acres
Capacity: 18,000 Tons Annually

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Over 5,000 Tons in Stock of

Beams, Column Sections, Angles, Tees, Plates, Bars, Checkered Floor Plates, etc.

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Structural Steel Co., Ltd.
Main Office and Works, Montreal

Saugeen Bridge, Paisley, Ont.

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WELLAND
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OTTAWA
417 NEW BIRKS BLDG.,
MONTREAL

STANDARD STEEL CONSTRUCTION CO.
LIMITED
WELLAND - CANADA
MANUFACTURERS AND ERECTORS
STEEL BUILDINGS AND BRIDGES

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"ACME" REGD
STONE BREAKER
FOR
STONE, ORE, ROCK ETC
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CONCRETE & TAR MACADAM MACHINERY
GYRATORY & ROLLER CRUSHERS
GOODWIN, BARSBY & CO LEICESTER ENG.

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1182 Broadway, New York.

Sarnia Bridge Company Limited

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Steel Buildings

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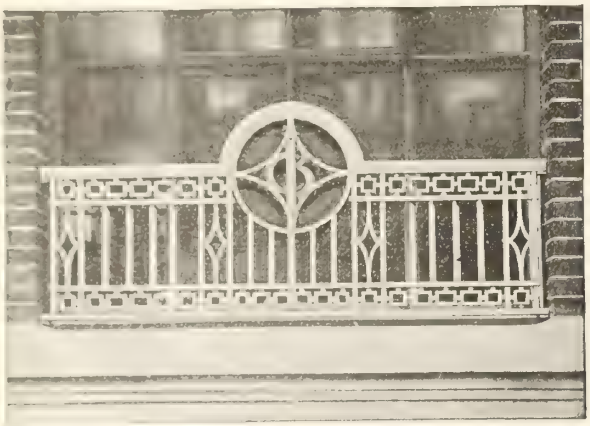
CONTINUOUS STAVE PIPE for Hydraulic Power plants and water conduits—all sizes up to 12 feet.

COSTS LESS THAN IRON OR STEEL AND AS DURABLE.

NATIONAL PIPE & FOUNDRY CO., LIMITED

211 McGILL STREET, MONTREAL

Ornamental Iron and Bronze Window Guards



Attractive and substantial examples of our ornamental metal work are to be found in many of Canada's best buildings. If you are now figuring on this class of work let us send you our Portfolio of Building Details in Metal showing photos of some of our work, and estimates on the work you have in hand.

The Dennis Wire & Iron Works Co. Limited

General Office and Works
London, Canada

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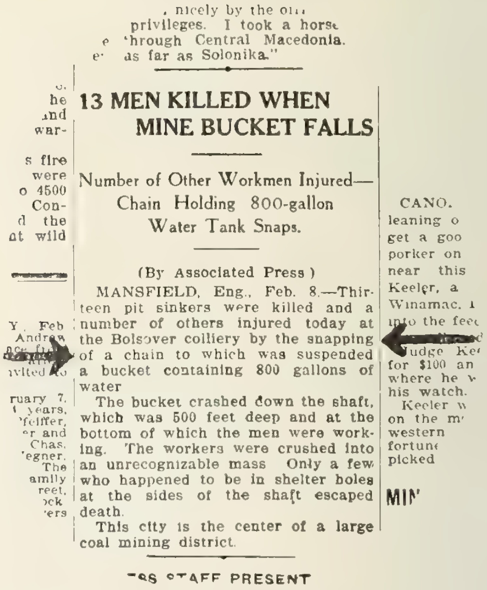

13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

(By Associated Press)

MANSFIELD, Eng., Feb. 8.—Thirteen pit sinkers were killed and a number of others injured today at the Bolsover colliery by the snapping of a chain to which was suspended a bucket containing 800 gallons of water

The bucket crashed down the shaft, which was 500 feet deep and at the bottom of which the men were working. The workers were crushed into an unrecognizable mass Only a few who happened to be in shelter holes at the sides of the shaft escaped death.

This city is the center of a large coal mining district.

Save money as well as loss of life and property by using a Canadian made electric-welded chain.

McKinnon Chain Company

St. Catharines, Ont.

EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

Toronto Representatives: Black Building Supply Co., Mail Building
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Hard Wall Plaster

Manufactured by

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Engines and Boilers

of all types and sizes, Heaters, Tanks, Pumps, etc.

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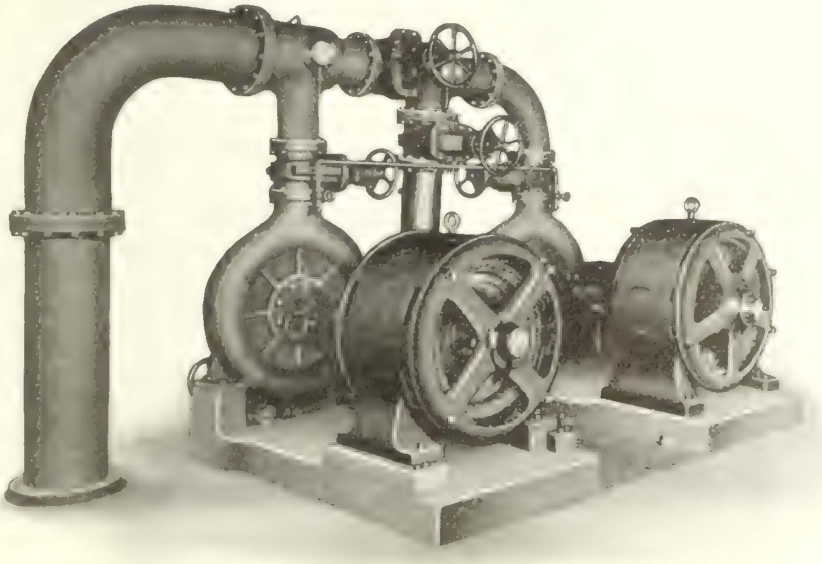
Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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It is a well known fact tnat the **first** 500 piles driven in **Toronto Harbor** were driven by a **Marsh & Henthorn Hoist** this being the first work done on the 20,000,000 Dollar Contract before any other make of hoist was on the job. Notwithstanding the statement of other manufacturers to the contrary. **This** proves the superiority of **Our Hoisting Engines.**

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The best at lowest cost. ***Let us figure on your requirements.***

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MAKERS OF HOISTING MACHINERY
Sales Agents: MUSSENS LIMITED, MONTREAL, QUE.

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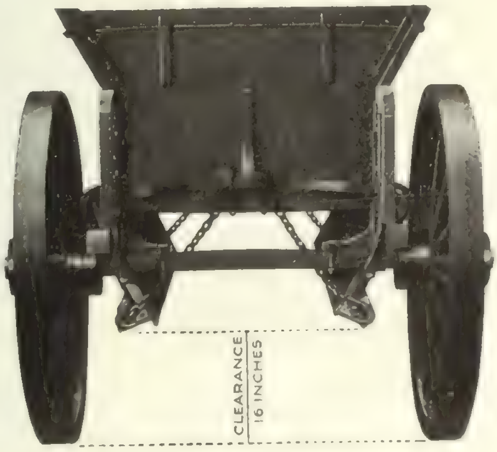

in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

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Proven Merit

By actual use in many structures and by scientific tests Harbour sand lime bricks have been proved an ideal building material.

Tests made at the University of Toronto at different times showed the crushing strength in pounds per square inch as: 4180, 4020, 4050, 4130. This is proof of uniformity in strength.

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50 Front Street E.
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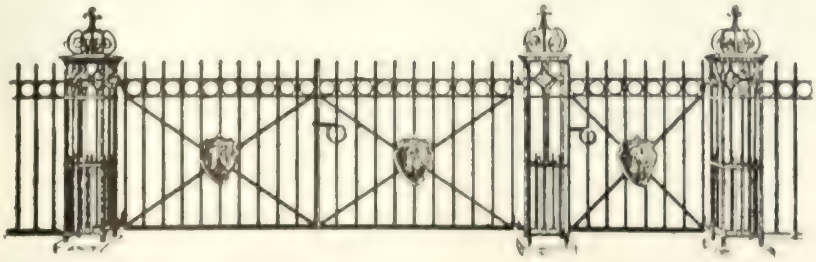

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Prices and Particulars cheerfully furnished

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Toronto Wire, Iron & Brass Works
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MEADOWS BLOCK, WELLINGTON ST. WEST

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GLASS
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THE TORONTO PLATE GLASS IMPORTING COMPANY, LIMITED

Plate, Window, Figured, Stained, Wired, Bent, Mirror
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The Maritime Bridge Company, Limited

Successors to

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Manufacturers of

**Bridges—Steel Buildings
Roof Trusses — Turntables
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Large Tonnage of Plates, Shapes and Bars in Stock

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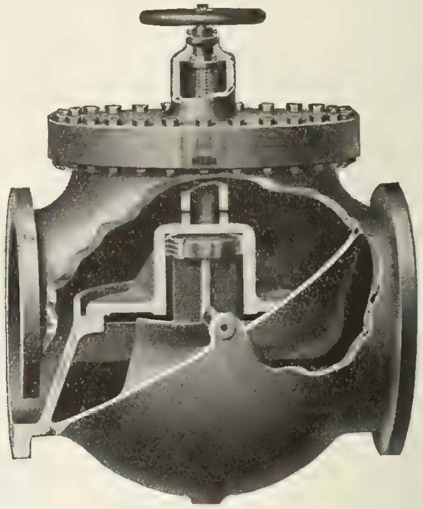

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We make automatic exhaust relief valves of all sizes and types—horizontal, vertical, angle and downward discharge. An inside dashpot of ample size eliminates shock in closing and a water seal insures the valve against leakage.

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Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

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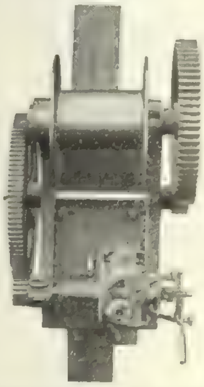

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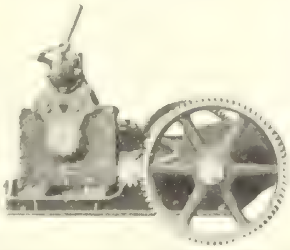

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"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

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Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

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LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, Carried in Stock
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Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe
for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

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We will quote you attractive prices on any of the above—write us.

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Manufacturers of the well-known

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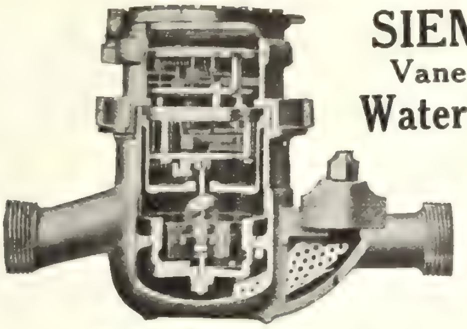

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Vane Wheel
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Dry Running Type

The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

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MEXICAN EAGLE ASPHALT

TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
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7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it.
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

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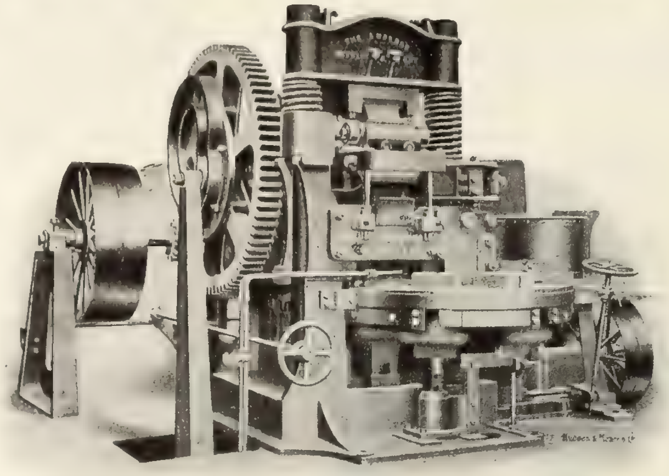
BRICK PLANTS



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Clay, Slag,
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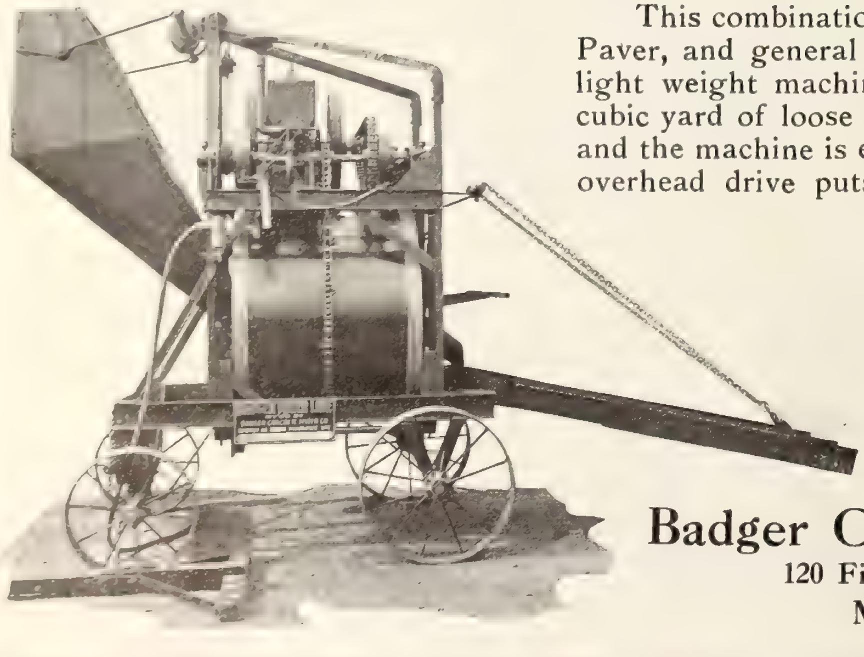
Badger Road Builder
Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

Write for our prices—they will interest you.

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Towers and Tanks for all purposes.

Concrete Mixers

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Water supply outfits of every description.

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"Metallic"

A Fireproof Lathing is Made of Steel!

For Fireproof construction there is no lathing which will lend itself to variety of design like

"Hayes' Patent Steel Lath"

It grips the mortar or plaster permanently. There is no contraction or expansion. Requires less mortar than any other.

In modern buildings the Plastering is often the cause of contention between Contractor and owner. What is gained by a poor finish to a good job?

Many a "repeat" contract has been lost because of split and cracked walls, and falling ceilings.

Write us for full information regarding "Hayes' Patent Steel Lath—"The Lath that does a good job credit."

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TORONTO AND WINNIPEG

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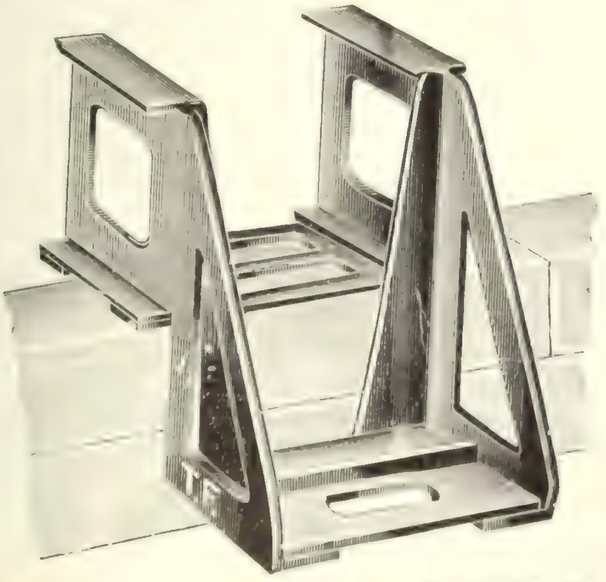

Over 40 Styles and Sizes

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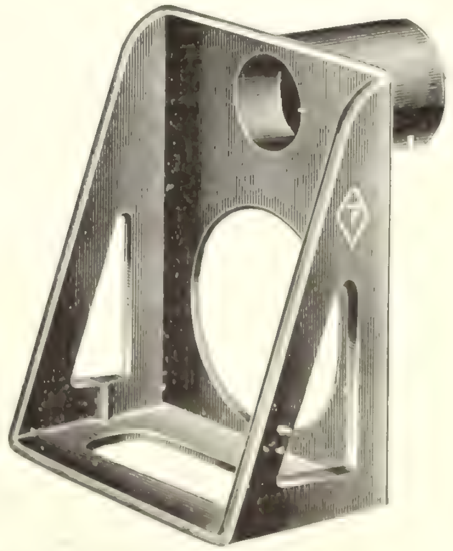

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Taylor-Forbes Company Limited, GUELPH, ONTARIO

and

1088 King St. West, Toronto
246 Craig St. West, Montreal

H. F. MOULDEN & SON, Winnipeg
P. D. McLAREN, LIMITED, Calgary

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl.; car lots, $1.55. Pkgs extra.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red and buff brick, $18; common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick, $8.60; King Edward siding, $7.50 at the yard; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18. Brick 2½ x 4 x 8½ in., blocks 3½ x 4 x 8½ in.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—[illegible] and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 65c.

MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.90 car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—$1 per ton, car loads, on cars.

Gravel—$1.35, f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. Copper bearing sheets—flat, Apollo keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—British Manilla, 15c basis per pound; second grade, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

Winnipeg Prices

LUMBER (BUILDING MATERIALS)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car-load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.80 per cu. yd.

Gravel—Per yd., delivered, $1.90.

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

Paints and Oils—White lead, ground in oil, $8.80 per 100 lbs.; boiled liseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.80 per bbl.; putty in 25-lb. tins, $3.20; turpentine, in bbls., 80 cents per gal.

(Continued on page 106)

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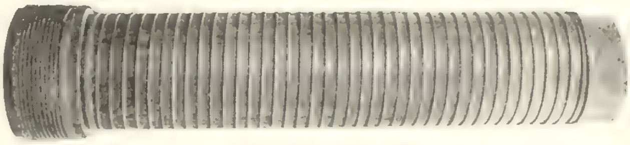

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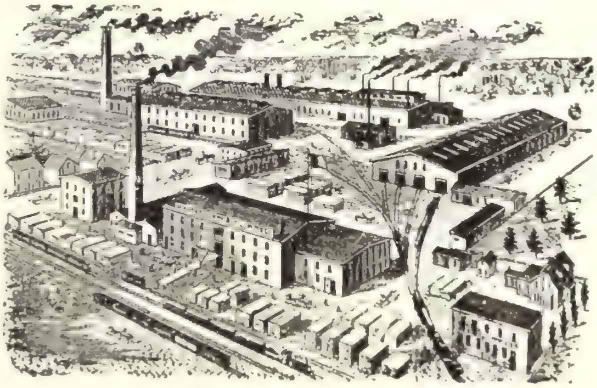

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

TRADE CONDITIONS AT VANCOUVER

[illegible] operations in the Vancouver [illegible] as active during May as had been anticipated and in consequence the demand for most classes of building and engineering materials, particularly at the close of the month, was a little disappointing. The only outstanding evidences of building activity in this vicinity at the present time are to be found in the Point Grey district, where a considerable number of good-sized dwelling houses are in course of erection and many others are in contemplation. In the city itself, though the volume of construction projected for the summer months is fairly encouraging, there is apparently insufficient work in view to warrant the promise of anything better than a moderate call for most classes of materials during the present season. Enquiry for paints and oils during the last few weeks has been most satisfactory and the prospects for June are reported reasonably bright. In the crushed stone, sand and gravel market business is reported quiet with the outlook somewhat uncertain. The same can also be said of the steel and iron market. Cement, lime, brick and similar supplies are moving only in moderate volume, but local demand for lumber appears to have picked up to some extent with, however, no immediate prospect of an improvement in prices. An advance of five cents in boiled linseed oil and raw linseed oil comprises the only change in prices since last month's review.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.25; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SUNDRIES AND SPECIALTIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls., 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

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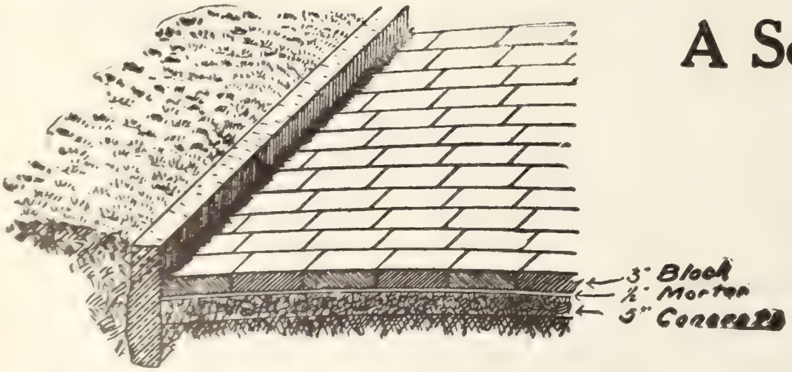

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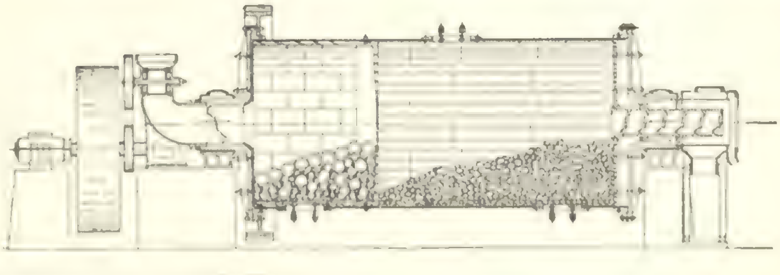

This mill is intended for receiving the rock direct from the Crusher after it has been reduced to particles about ½ inch and finer.

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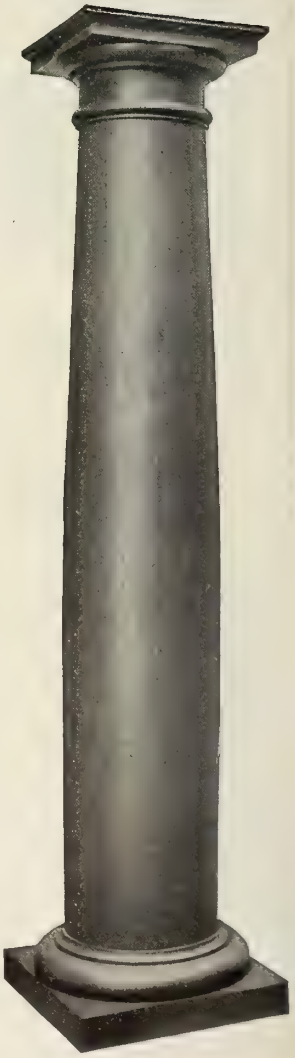

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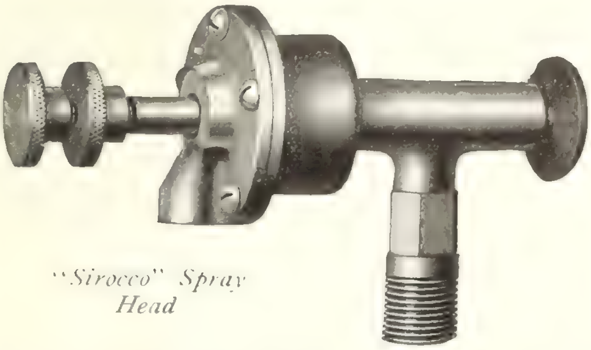

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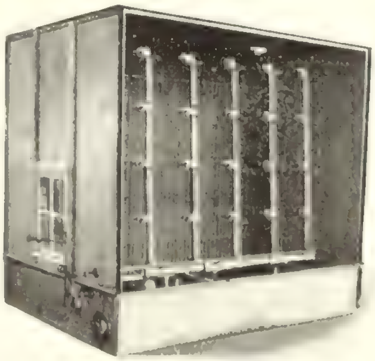

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For the Protection of Steel

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LIDGERWOOD CABLEWAYS

FOR EXCAVATION AND CONSTRUCTION

H. E. Talbott & Co., Contractors **Mr. G. F. Hardy, Designing Engineer**

An interesting application of cableways for both excavation and construction is shown in the above illustration of work now under way at Grand'Mere, Que., for the Laurentide Co.

The work includes building a dam and power house, excavating 110,000 cu. yds. of solid rock and placing 175,000 cu. yds. of concrete.

Three Lidgerwood Cableways are employed. The long span is 1,683 ft. (towers at extreme ends in picture). This cableway takes concrete from the mixing plant, rock and sand storage (extreme right in picture) to the dam and power house. The intermediate span, 1,118 feet, takes rock to crusher and storage pile. The short span, 614 feet, takes the rock, sand and cement, to the small auxiliary crusher plant on top of the present mill building, where the concrete is discharged directly into the power house foundation and walls.

The long span cableway handling concrete in [illegible] batches has delivered 387 cu. yds. in a 10-hour day at 1,100 ft. distance.

There will be a fourth cableway [illegible] the dam at the right in the picture.

The [illegible] latest improved aerial dumping [illegible]

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Equipped With Baker Armored Expansion Joints and Triangle Mesh Reinforcement

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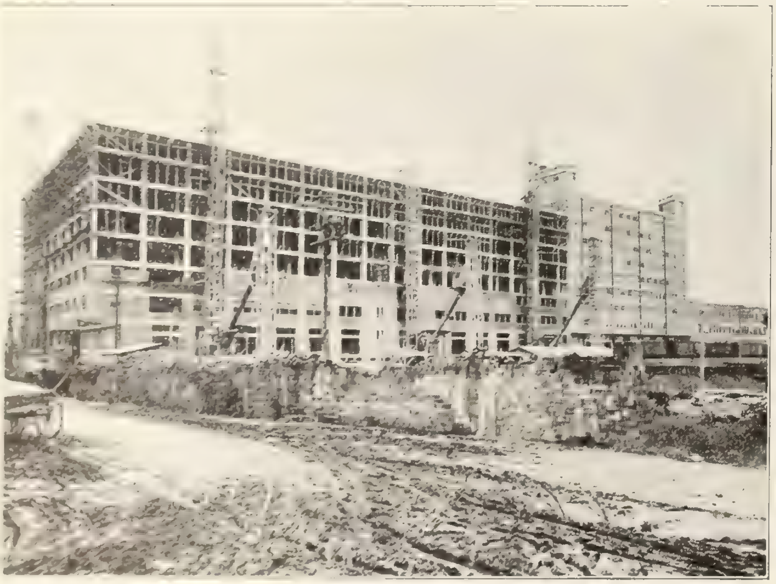

View of Sears-Roebuck Company Building, under construction, Dallas, Texas

REINFORCED CONCRETE FLAT SLAB CONSTRUCTION

(Patented)

The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

All infringers are being rigidly prosecuted, as Mr. Turner has in his employ at the present time five of the best known and most able firms of patent attorneys in the United States.

OWNERS, PROTECT YOUR OWN INTERESTS by demanding that your flat slab designers furnish an infringement bond of an amount equal to the cost of your building. Demand a bond for a five-year term and make yourselves safe.

THE MUSHROOM SYSTEM

is the original reinforced concrete flat slab system and is the only legitimate flat slab on the market today.

For designs, estimates and suggestions embodying the best of our long experience, you have only to consult our Engineers, without any obligation on your part.

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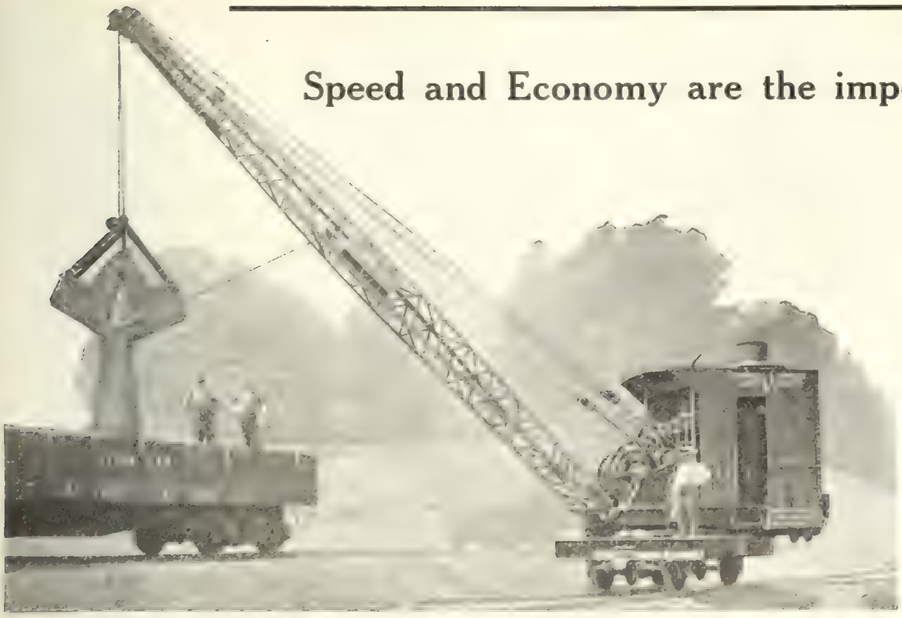

when handling sand, gravel, crushed stone, coal, ore, etc., from and to cars, wagons, bins, and stock piles.

BROWNHOIST
Locomotive Cranes

will handle your material speedily and economically.

10-ton Brownhoist Locomotive Crane used by Britnell & Co., Ltd., Toronto, Canada.

Speed The Brownhoist Locomotive Crane handles 60 to 120 tons per hour of these loose materials, with one or two men besides the operator. It replaces 20 to 30 men on this kind of work.

Economy The cost of the crane is $8 to $9 per 10 hr. day, which includes operating, interest on the investment and depreciation. By replacing 25 men, it saves $30 to $40 per day. And the crane can be worked both day and night.

Send for Catalog K which shows how and where these cranes are used

THE BROWN HOISTING MACHINERY CO., CLEVELAND, OHIO
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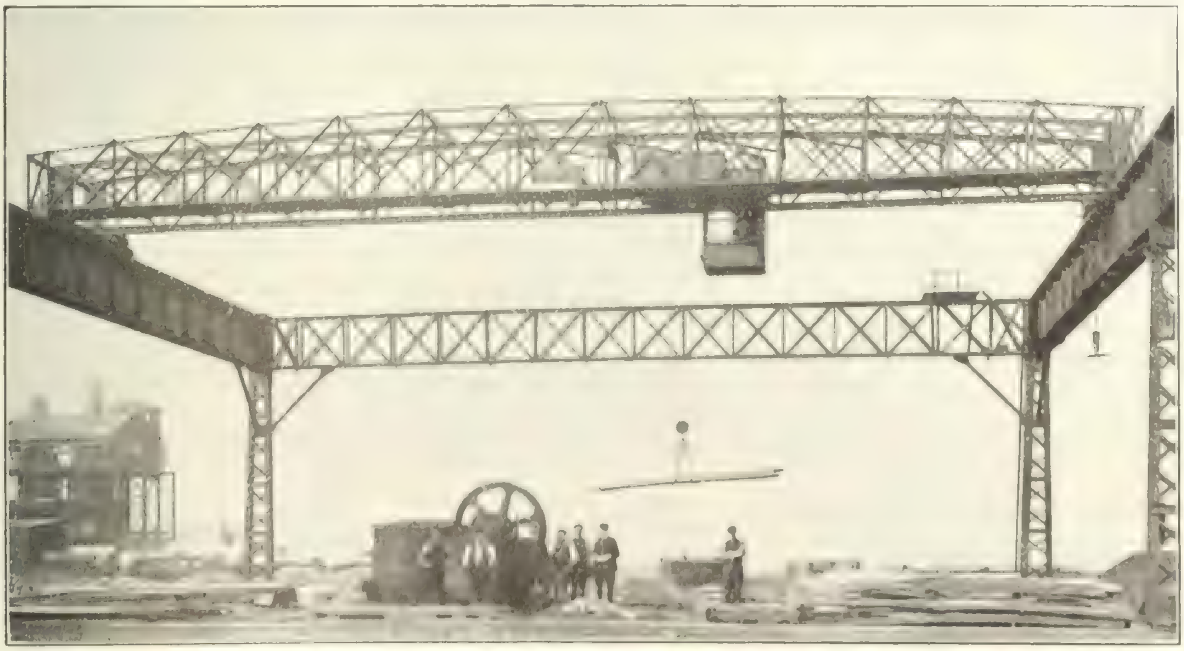

Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

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Electrical
Cranes
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Include Royce Crane Type Motors, Controllers, Over Hoisting Safeguard.

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CRANES TELFERS CAPSTANS WINCHES

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THE H. & E. PATENT BALL-BEARING LIFTING JACK

For Railway and Bridge Work, Contractors' and Builders' Use

Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

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CANADIAN BRAKESHOE CO., LIMITED
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Insulating Underground Pipes

Its
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Will appeal to you.

Write for Catalog W.

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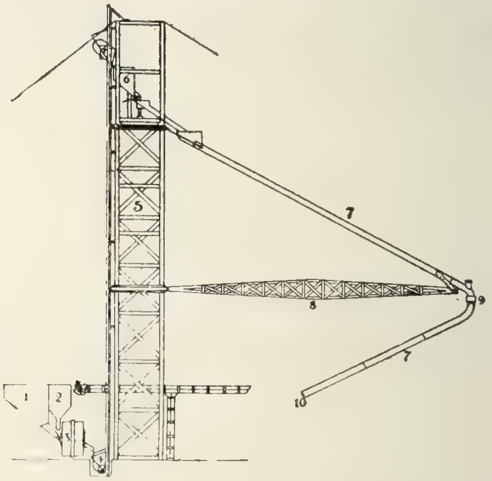

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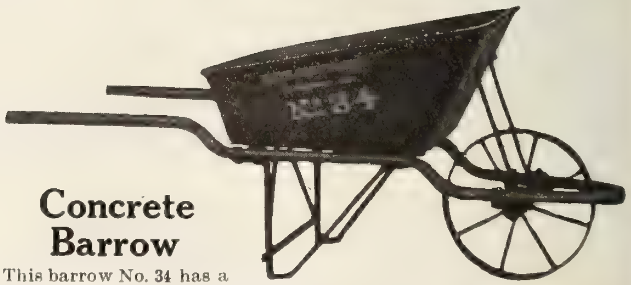
ERIE

The Erie Concrete Barrow No 20 has a welded tray made without rivets. It is watertight and can not burst open. Well braced channel iron legs; wheel guarded; forward or side dump.



Concrete Barrow

This barrow No. 34 has a welded tray, no rivets and is absolutely watertight. Wheel guarded and has forward or side dump. WRITE US.

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No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

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Withee, Wis., 1-29-14

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Jackson, Michigan.

Gentlemen:—

The No. 9 Coltrin Mixer that I have has been in constant use in the summer season for the past three years and has been more or less abused owing to various ones running same. Since I purchased the machine second hand a year ago, my expense for repairs was my order of recent date, $3.70, and this could have been avoided. I am highly pleased with its make-up and can recommend the Coltrin Mixer with pleasure, to anyone.

I am sending you a photo of one of my jobs with this machine the last season. There are 227 cu. yds. in the piers and were laid in three days, which testifies to its capacity.

Yours very truly,
(Signed) R. L. SANDERS.

The Coltrin Continuous-Batch Mixers

Shipped Anywhere on Trial

For Sale by Bournival & Co., 333 Notre Dame St. East, Montreal, Que.

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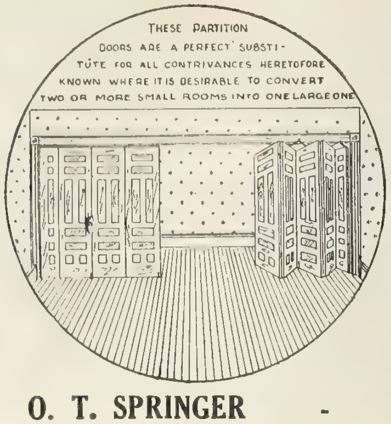
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is far ahead of all other dividing doors for simplicity of construction, inexpensiveness of material and adaptability.

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Raising the Wreck of U.S. Battleship Maine

Bulletin 102 Edition 2
Just off the Press

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in the Maine work through the driving, filling of cofferdam pockets, unwatering and pulling of piling offer strong evidence of the success which is achievable in cofferdam and foundation work by proper use of this sheet piling. A copy of this bulletin will be sent to engineers and contractors on application.

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of any Size and in any Quantity on hand for Sidewalks, Roadwork or Concrete Work.

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Why Use Expensive Pipe When Butted Tubing Will Do?

Send for prices and full particulars about our butt joint and structural tubing.
You will find it is more economical in cost than ordinary pipe and will answer every requirement for which you might buy more expensive material.

Standard Tube & Fence Co., Limited
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Manufacturers of
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Steel Structures

to support them.

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Municipal Filtration and Water Softening Plants

Designed,
Installed and
Operated
by Experts

We GUARANTEE
Results under all
Conditions

Write us for our "Red Book" on Water Softening and Purifying

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Canadian Agents:

LAURIE & LAMB
Board of Trade Building, MONTREAL

"BUFFALO" FANS
KEEP THE AIR MOVING

A "BUFFALO" DISK FAN

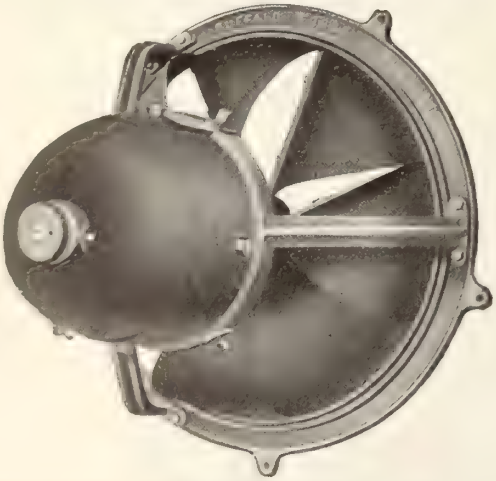
will remove that foul, overheated air and replace it with fresh invigorating air direct from the outside.

Why swelter next summer. Play safe. Equip with a "Buffalo" Disk Fan.

We offer a simple and inexpensive means of moving large volumes of air at low pressures or against small resistance. No other device is so effective or economical for cooling rooms in which heat is generated such as laundries, engine and boiler rooms, veneer rooms, etc.

Bulletin No. 262-12 illustrates and describes these fans in detail. Let us send you a copy.

CANADIAN BUFFALO FORGE CO.
BERLIN **Limited**
ST. JOHN MONTREAL TORONTO WINNIPEG VANCOUVER



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FOR
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Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

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Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00

The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons, 102 pages. Illustrated. Price 50c.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited, London. 618 pages, well illustrated. Price $2.00.

A Treatise on the Inspection of Concrete Construction, by Jerome Cochran, C.E. Published by Myron C. Clark Publishing Company. 594 pages. Price $3.00.

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Address enquiries to our nearest office

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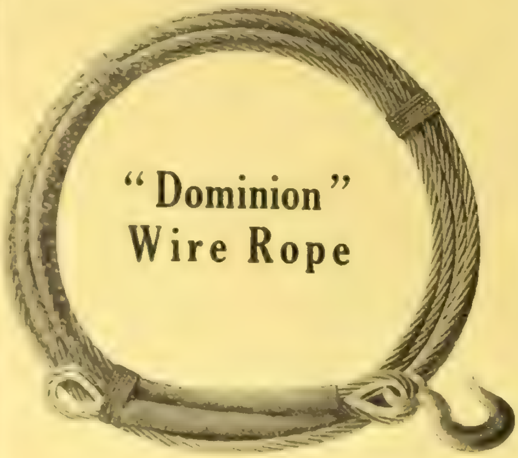
Successors to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C P R Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg



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We manufacture special ropes to take care of your particular needs.

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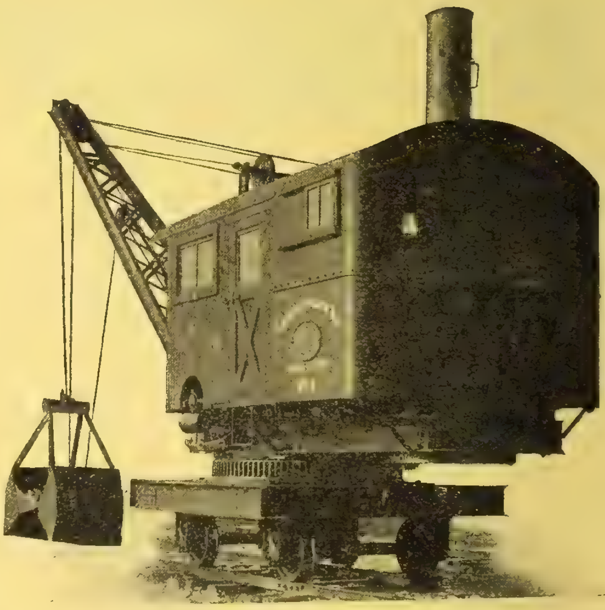

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For Every Purpose

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We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., HEAD OFFICE MONTREAL

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, June 17, 1914 No. 24

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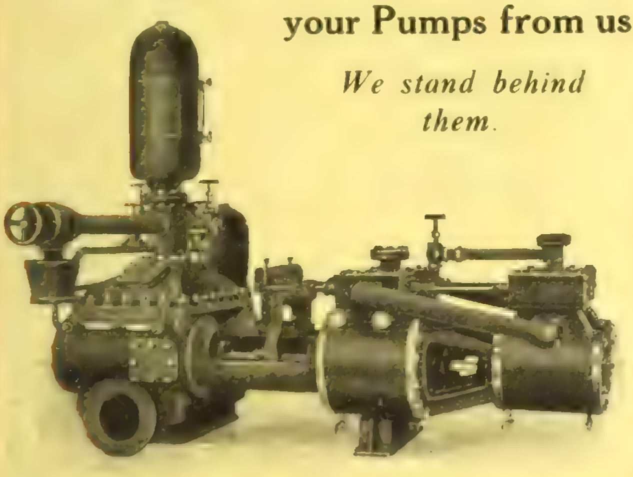
Blot out your troubles, and buy your Pumps from us.

We stand behind them.



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Made in all Kinds of Glass on Short Notice

Large Bent Plate Glass for Shop Fronts a Specialty

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Air Compressors
OF BELLISS MAKE
have gained their reputation for

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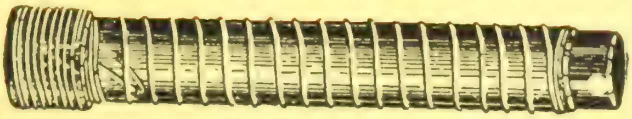

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RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
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Full Particulars and Estimates Furnished

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

"Announcement"

In addition to a full line of other types of crushing machinery and equipment we are now building

Gyratory Crushers

of most modern design and equipped with an improved

Water Cooled Eccentric Bearing

Made in all sizes for all capacities and for crushing any kind of material.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catherines Toronto Montreal Cobalt South Porcupine
Vancouver and Nelson

One man takes a chance, that's gambling; another buys "AMERICAN" Steel Derricks, that's good business, which is nothing but sound common sense.

Every possible stress and strain is covered by the carefully calculated and proportioned construction of these derricks.

An "AMERICAN"
Fifty-Ton Steel Guy Derrick

is shown here working on the Hardaway Contracting Company's big hydro-electric power construction at Whitney, N.C. It is lifting a 96,000 pound casting of a Gates crusher. This derrick has a monster 5 sheave block—as tall as a man.

Greatest safety, longest service—You get them both when you buy "AMERICAN" Steel Derricks.

MADE BY

American Hoist & Derrick Company
ST. PAUL, MINN., U. S. A.

SOLD BY

General Supply Co. of Canada, Ltd., Montreal, Ottawa, Toronto. Stuart Machinery Co., Winnipeg, Man.
Vancouver Machinery Depot, Ltd., Vancouver, B. C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

Medicine Hat Reservoir

Capacity 3,000,000 gallons, 208 ft. long, 96 ft. wide, 20 ft. 4 in. deep. Floor 9 in. thick, thickness of walls, top 12 in., bottom 24 in.

Composition of concrete used, one part Canada Portland Cement, two parts Sand and four parts Aggregate.

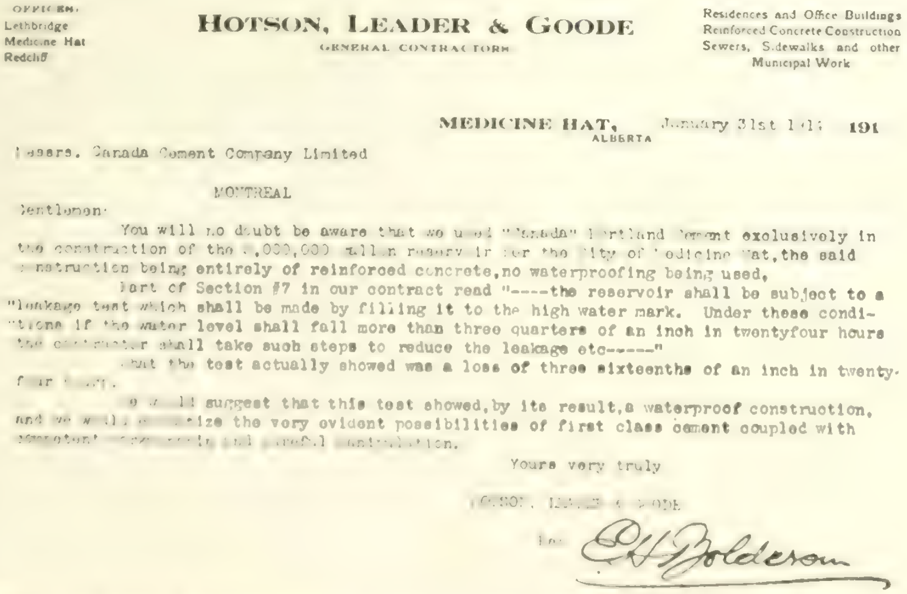
Consulting Engineers, R. S. & W. S. Lea, Montreal.

City Engineer, R. K. Grimmer.

Inspecting Engineer, R. Piper.

Waterproof Concrete

The reservoir at Medicine Hat, Alta., built entirely of reinforced concrete, without any waterproofing compounds, has demonstrated by actual test, the possibility of making concrete waterproof. The results of the test, as contained in the following letter, showed the waterproofing quality of the concrete to be four times as great as that specified.



OFFICES:
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HOTSON, LEADER & GOODE
GENERAL CONTRACTORS

Residences and Office Buildings
Reinforced Concrete Construction
Sewers, Sidewalks and other
Municipal Work

MEDICINE HAT, ALBERTA January 31st 1913 191

Messrs. Canada Cement Company Limited

MONTREAL

Gentlemen:

You will no doubt be aware that we used "Canada" Portland Cement exclusively in the construction of the 3,000,000 gallon reservoir for the City of Medicine Hat, the said construction being entirely of reinforced concrete, no waterproofing being used,

Part of Section #7 in our contract read "----the reservoir shall be subject to a "leakage test which shall be made by filling it to the high water mark. Under these conditions if the water level shall fall more than three quarters of an inch in twentyfour hours the contractor shall take such steps to reduce the leakage etc-----"

What the test actually showed was a loss of three sixteenths of an inch in twenty-four hours.

We would suggest that this test showed, by its result, a waterproof construction, and we would emphasize the very evident possibilities of first class cement coupled with competent [illegible] and careful manipulation.

Yours very truly

HOTSON, LEADER & GOODE

Per C H Bolderson

Write for information about tanks, buildings and other uses of concrete, to

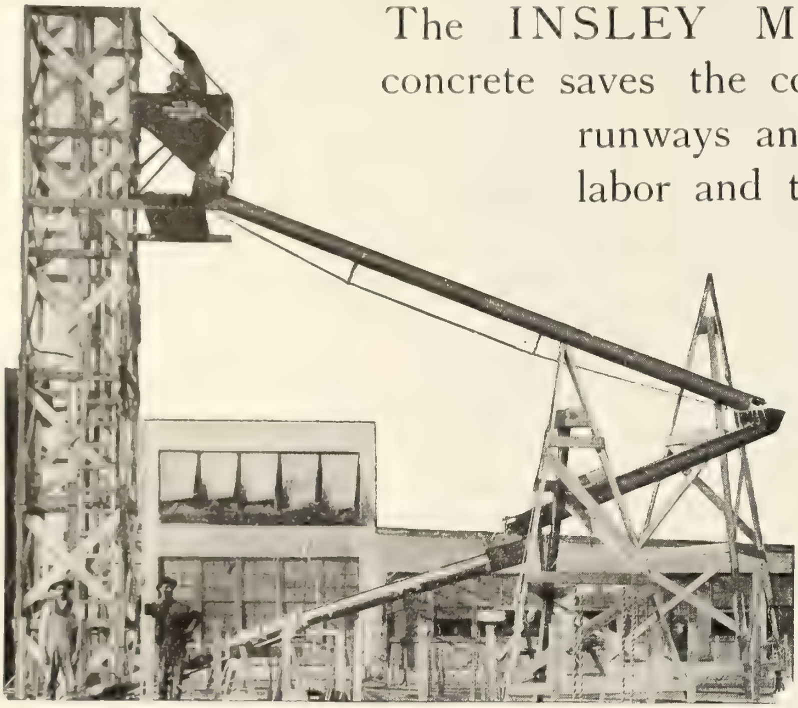
Information Department

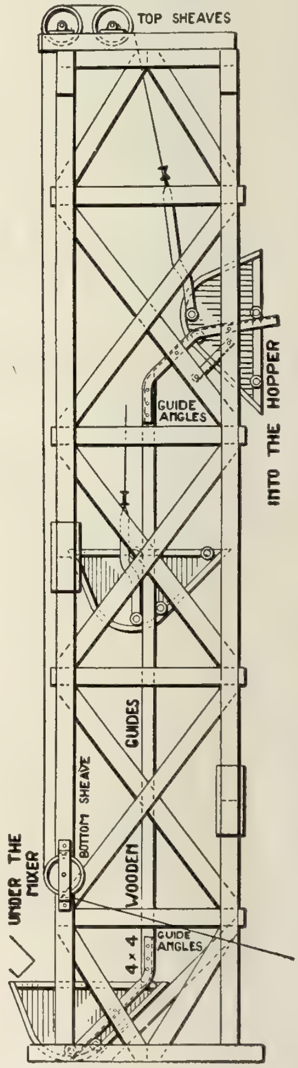
Canada Cement Company, Limited

882 Herald Building, Montreal

ECONOMY

The INSLEY METHOD of handling concrete saves the cost and inconvenience of runways and a large percentage of labor and time.





Automatic Concrete Hoist
Receiving Hopper and Gate
Continuous Line Spouting
Trussed Swivel Head Spouting

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In cost of equipment.
In cost of installation.
In cost of operation.
In time required to build.

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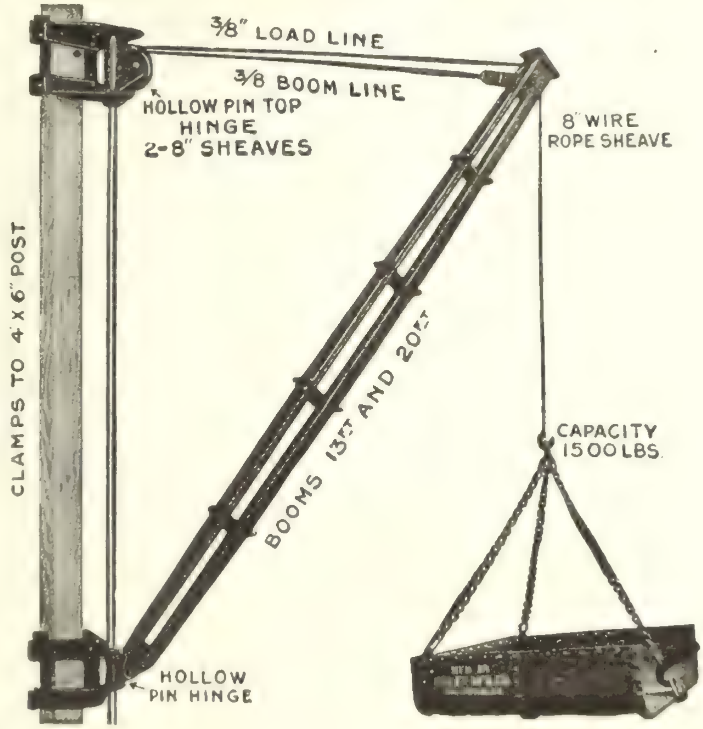
LABOR SAVING DEVICES

Portable Boom Derrick

(as illustrated)

Can be clamped to any Standard Concrete Tower. Will raise 1,500 lbs.---Light, Strong, built of steel throughout and swings through three quarters of a circle.



CROTCH FOR CRANE HOOK
ROUND CORNERS
SAFETY LATCH
TAPERS FOUR SIDES
THE LEVER LOCKS THE DOORS AUTOMATICALLY
MFD. BY INSLEY MFG. CO. INDIANAPOLIS, IND.
FLAT BOTTOM

Controllable Centre Dump Buckets and Cars

Special Buckets.
Stone Skips.
Concrete Chutes.
Concrete Distributing Plants.

Catalogues on request.

Mussens Limited

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(Continued on page 12)

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces

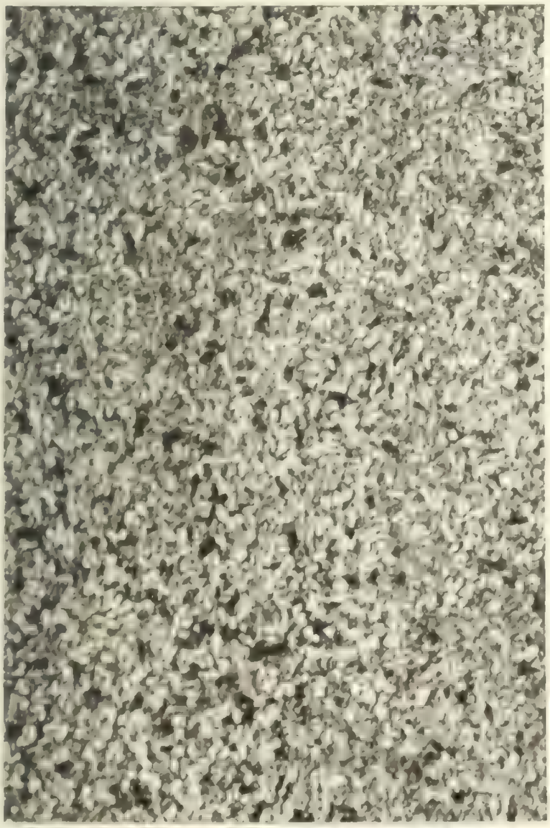
They cost less

They sell for more

You sell more of them

8 x 8 x 24 inch Granite Smooth Face Block

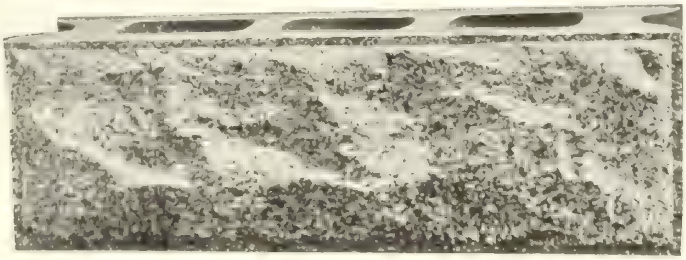
By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.



8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

MR. CONTRACTOR:—

Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

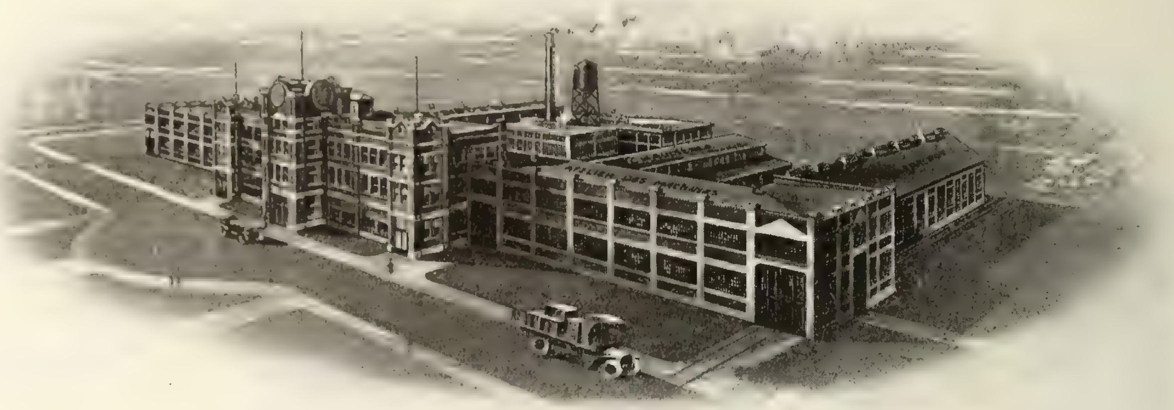
Canadian Zagelmeyer Co.

Limited

11 Howard Ave., Windsor, Ontario

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**



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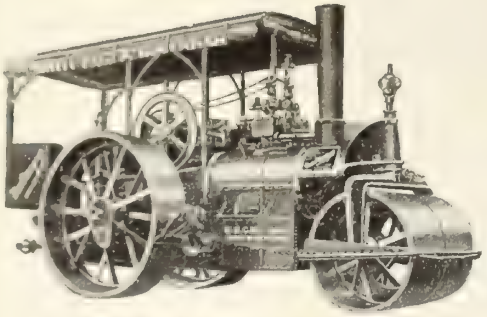
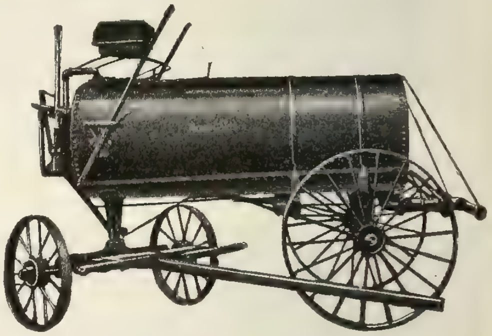


" Montmagny " Steam Road Roller.

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

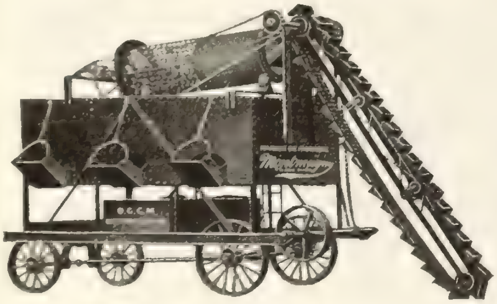
Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



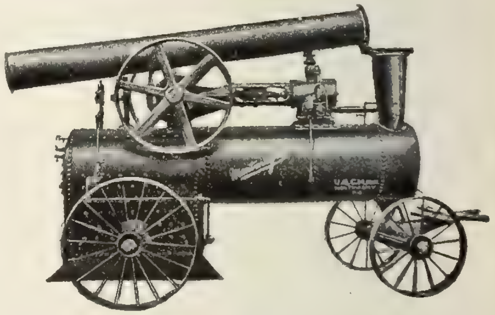
" Montmagny " Road Sprinkler.

The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.



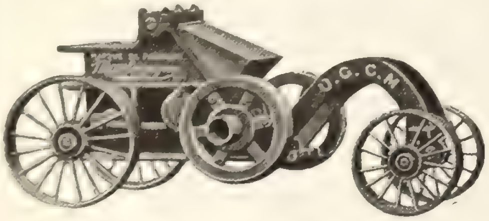
" Montmagny " Portable Steel Bin.

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.



" Montmagny " Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.



" Montmagny " Stone Crushers.

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Machinery

MODERN ROAD BUILDERS

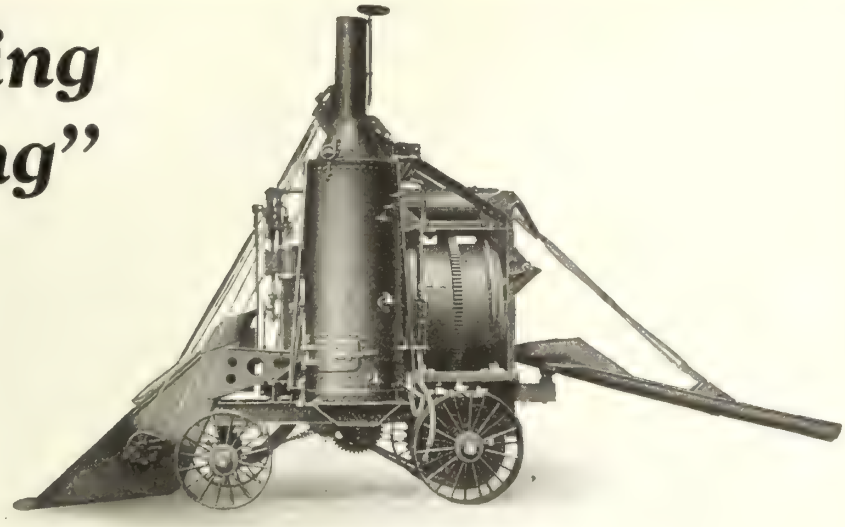
The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE

For crushing field stone, granite, etc., "Montmagny" jaws are made of manganese steel. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.

" Montmagny " Manganese Steel Jaw Plates

"Most Mixing Least Fixing"



M-C Rail-Track Paver, Showing 8 ft. Distributing Chute, For Roads and Street Work

Stronger! Speedier! Easier!

Yes Sir, that's just what the M-C Rail-Track Paver is. We refer you to any mechanical engineer who has examined it, or to contractors themselves, who are most enthusiastic as to its general merit. Compare the features, point by point, which we emphasize, then judge for yourself whether or not this is the paver for you.

M-C Rail-Track Paver

has 12 horse power steam or gasoline engine—mixes 11 to 12 cubic feet of concrete per batch, and then mixes it some more while spreading it. The mixer drum has the M-C Rail Tracks and other M-C patented features which insure—"Most Mixing—Least Fixing."

The traction has two speeds ahead and one speed reverse, a heavy set of brakes like on auto trucks, and the machine can travel up hill or down, any distance, easily, safely, surely,—without horses. One man controls all operations from one position, and the work is so easy he likes it. The machine runs like a road roller or a traction engine. Fill the mixer full every time, and with a properly organized crew you can turn out 1200 to 1400 street yards, 6 inches thick, per day.

The M-C Rail-Track Paver is just what you have always wished you could get.

Send for free catalog explaining it in detail

CANADIAN FAIRBANKS-MORSE CO., Ltd.

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Marsh-Capron Mfg. Company
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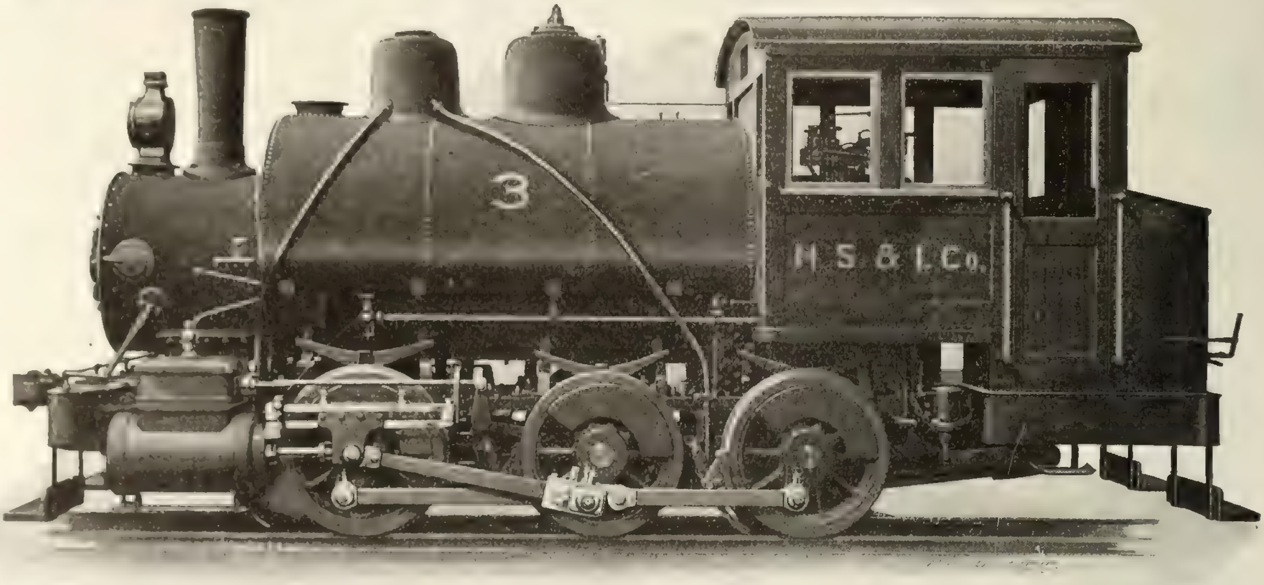

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty year experience as builders Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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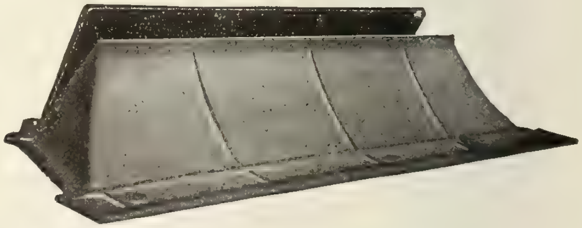
10 % Off

"COVERT IMPROVED" DAMPER



Owing to the increased sales of the "Covert Improved" Fireplace Throat and Damper we are pleased to announce to our friends and customers **a General Reduction of 10 Per Cent.** in the price of this specialty.

THE "COVERT IMPROVED" DAMPER

Used by the Canadian Bank of Commerce in various branches throughout Canada; the Ontario Provincial Government in Hospital installations; and in many other prominent buildings and residences.

Write for your copy of "Hints on Fireplace Construction"

Manufactured and Sold By

Black Building Supply Co., Ltd.

202 Mail Bldg. **TORONTO** **Telephone Main 331**

Standard Hoisting Engine

The London Concrete Machinery Co., Limited

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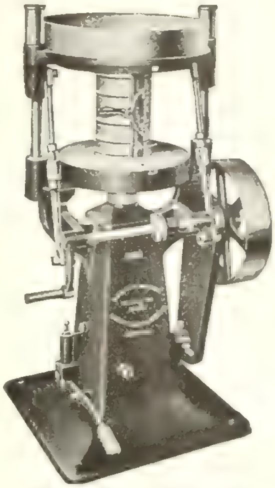
the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

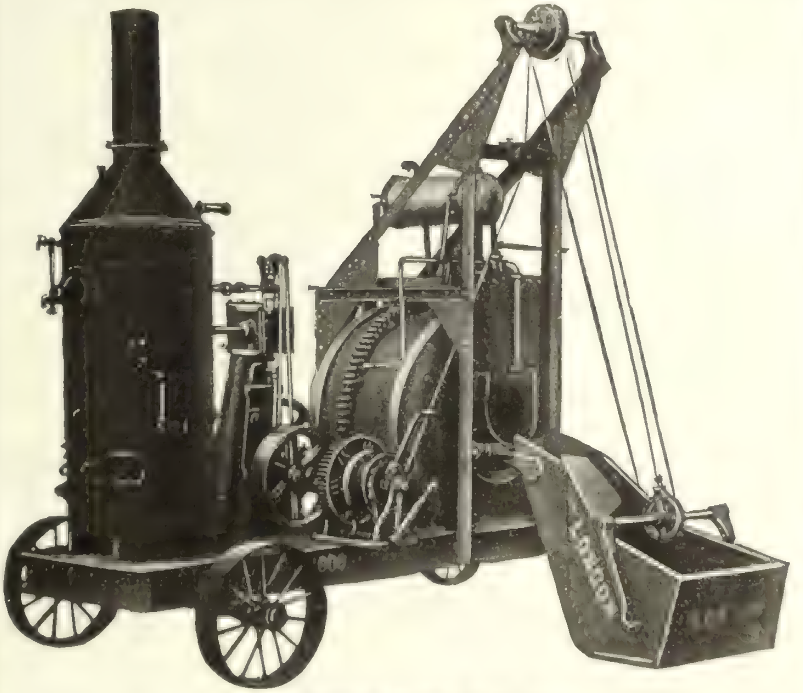
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

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—

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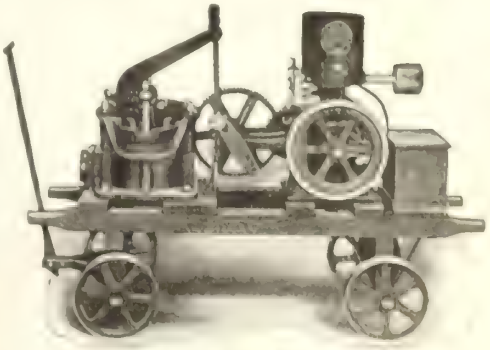
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

Correspondence Solicited.

Rear Discharge Paving Machine with Forward Loader



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Sturtevant Co. of Can. Ltd., B. F.

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are made in all types and for all purposes.

The long scale induction meter shown is particularly intended for switchboard use. It has the maximum possible scale-length for an instrument of its size.

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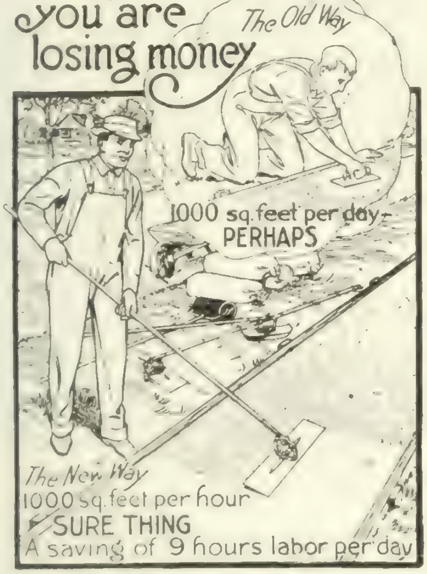
If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money



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MACHINERY

Western Road Machines have been in practical use for many years, and have given maximum satisfaction in the wide variety of soils.

They are very strong and durable, simple in construction and easily operated.

Western Road Machines are adapted to the various phases of work in the construction and maintenance of roads and ditches. For permanent hard roads the Aurora Rock Crusher is a most important factor in reducing the stone to necessary size.

We manufacture the most extensive line of earth and stone handling machinery of any concern in the world. Write for catalogue.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
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Agents for Eastern Canada

Macadam Roads

must be built of a
Tough
Stone
that will cement
WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Star Dump Wagons—made with plain or roller bearings—comprise the following essential qualities of construction and operation:—
Handmade white oak spokes.
Black birch hubs—A grade rims.
Sheldon square steel axles.
Iron work wrought and drop steel forgings.
Short wheel base—most efficient draft from front axle.
Strong winding arbor and foot trip—Boiler plate armored neck.

Write for prices and Catalog.

Why Some Contractors Make Money

Because they use the most economical equipment.

Star Dump Wagons built for every service will save you 30 to 40 per cent. of your hauling expense. The Roller Bearing wagons will handle 3 yards as easily as 2 yards with the same team.

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Canada's Departmental House for Mechanical Goods

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

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First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

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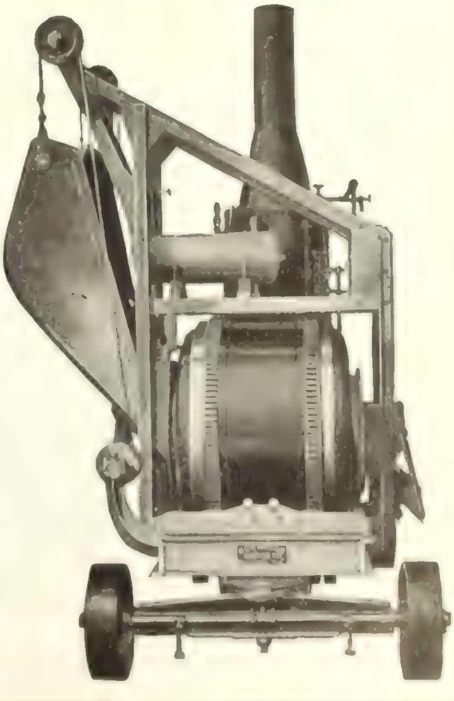

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If you should specify merely "a five-ply tar-and-gravel roof" instead of "a Barrett Specification Roof"—

You *might* get as good a roof as a Barrett Specification Roof, though built somewhat differently—

But on the other hand, you may get materials of uncertain qualities—

Or a roof with little or no pitch between the layers—

Or a scanty surface coating of pitch and gravel—And you wouldn't know about it until a few years later—*when the roof leaked.*

But if you put The Barrett Specification into your building specifications and see that it is carried out, you are sure—

1. That the materials will be right,
2. That they will be used in the right amount and in the right way,
3. That your roof will last upwards of twenty years without another cent of expenditure,
4. And that the cost per foot per year of service will be lower than it could possibly be with any other kind of roofing.

As Barrett Specification Roofs cost less than any other permanent roof to begin with and as their maintenance cost is nothing, the unit cost comes down to about ¼c. per square foot per year, a figure unapproached by any other roof covering.

Copy of The Barrett Specification with tracing ready for incorporation into your building plans sent free on request. Address nearest office.

Special Note We advise incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested: ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

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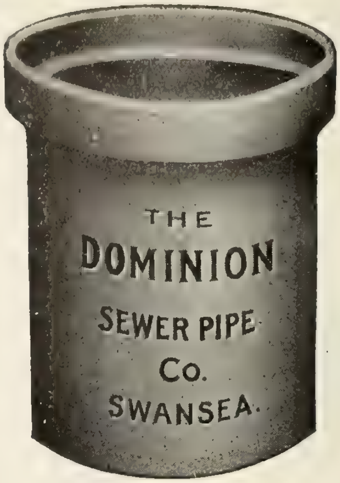

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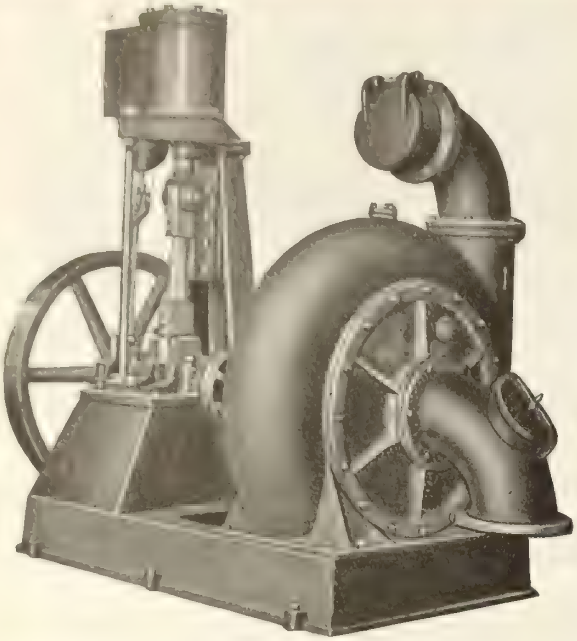

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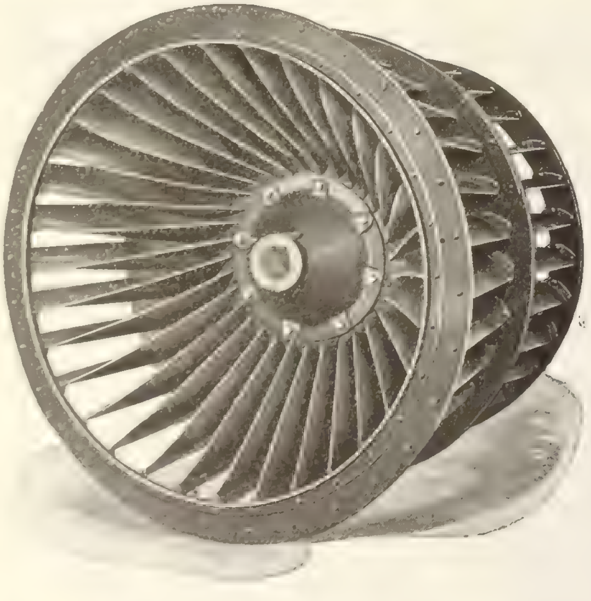

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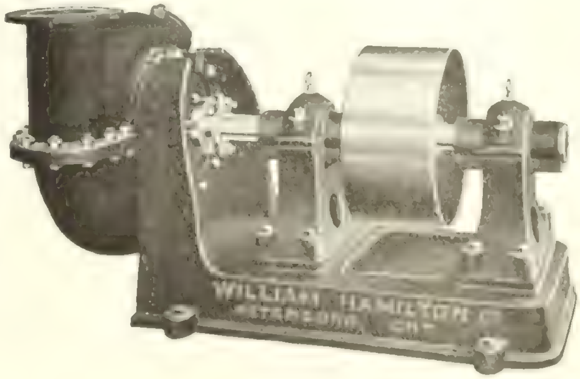

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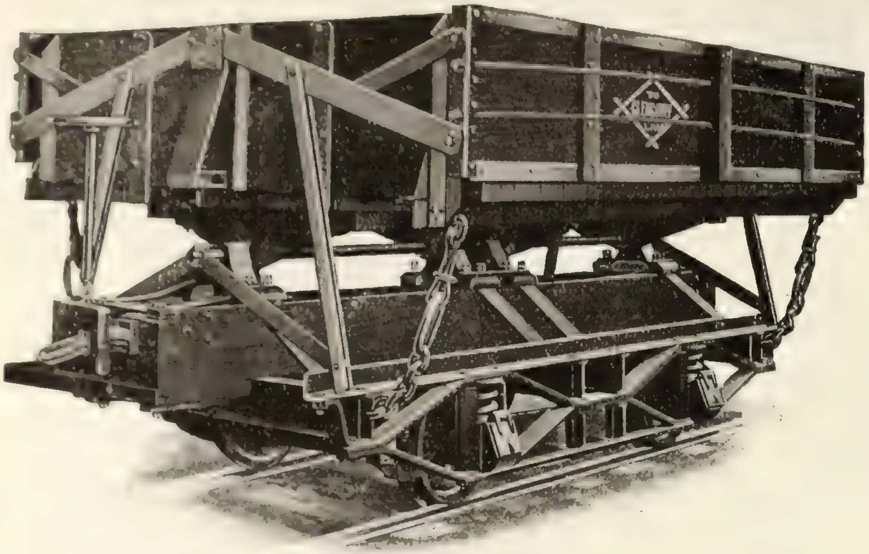

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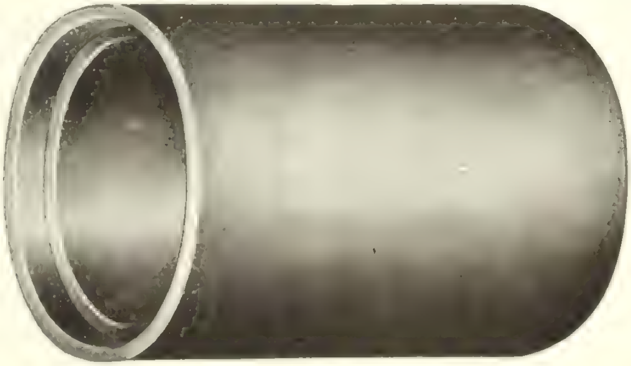

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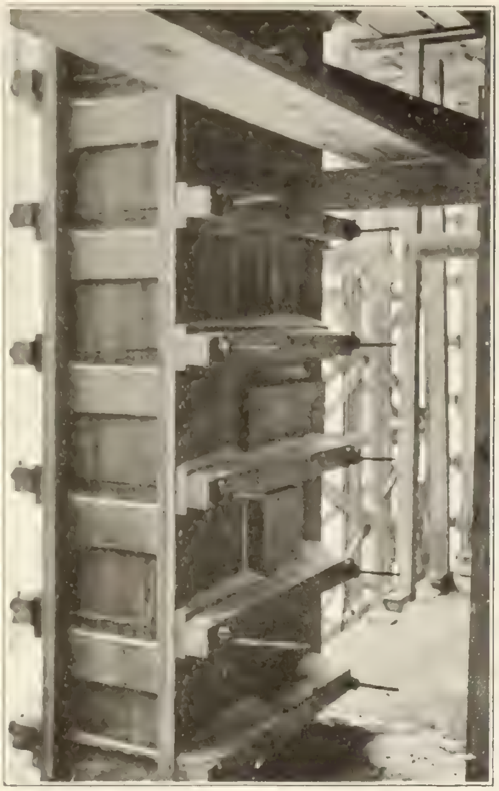
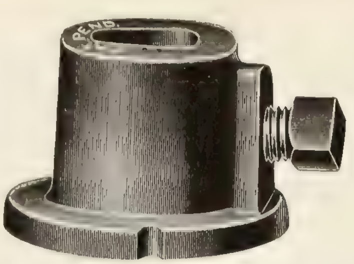


COLUMN

Above illustration shows very inexpensive, but effective way of clamping.



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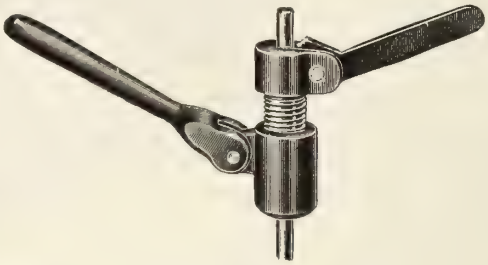

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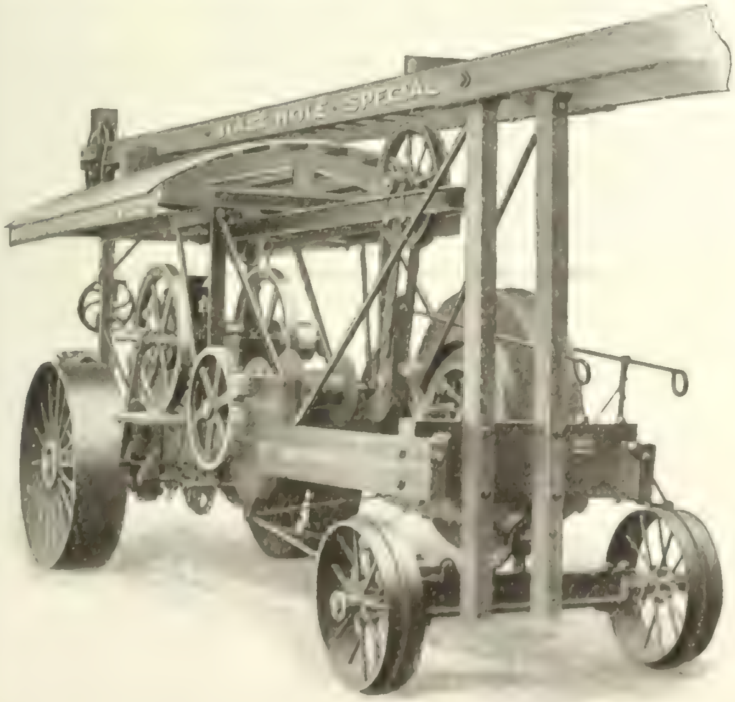

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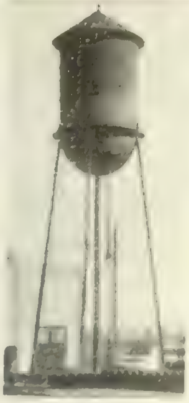

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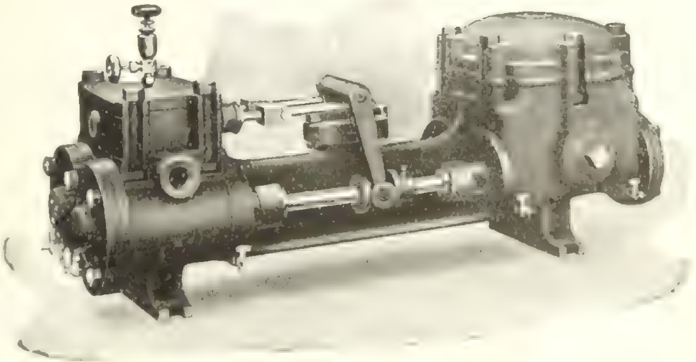

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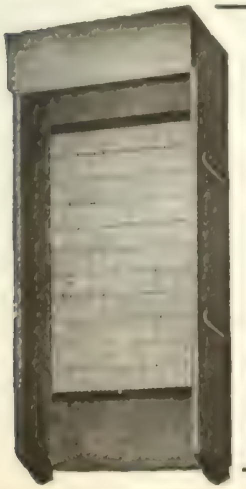

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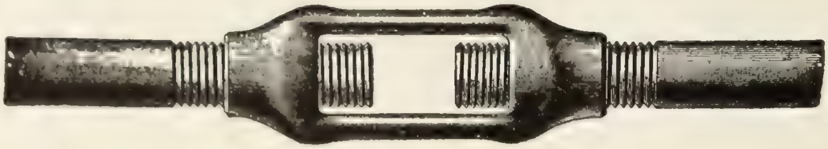

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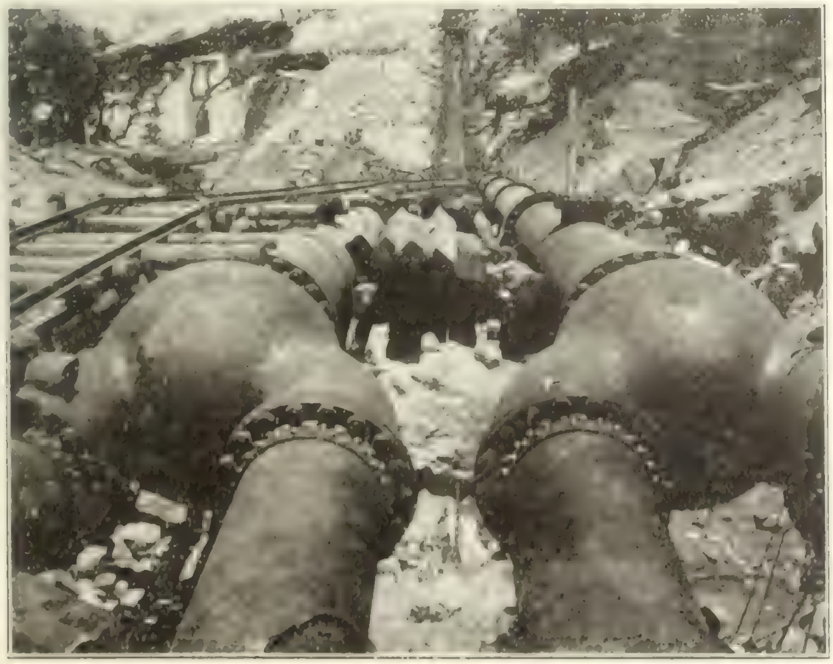

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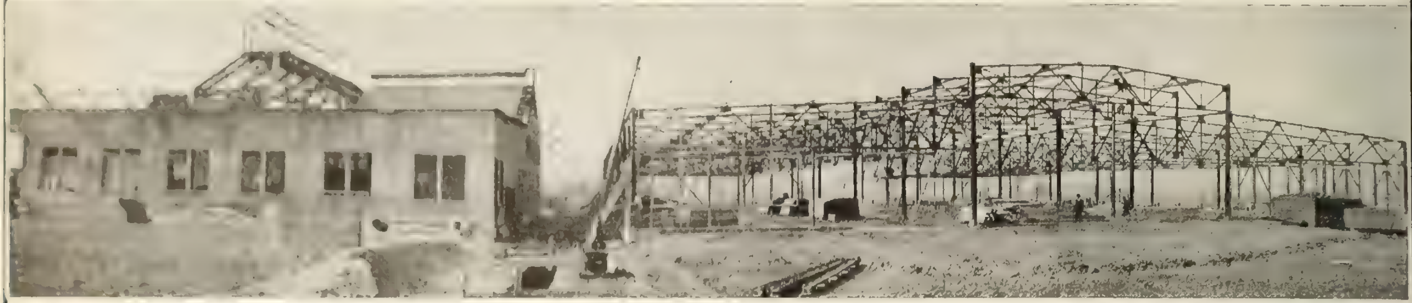

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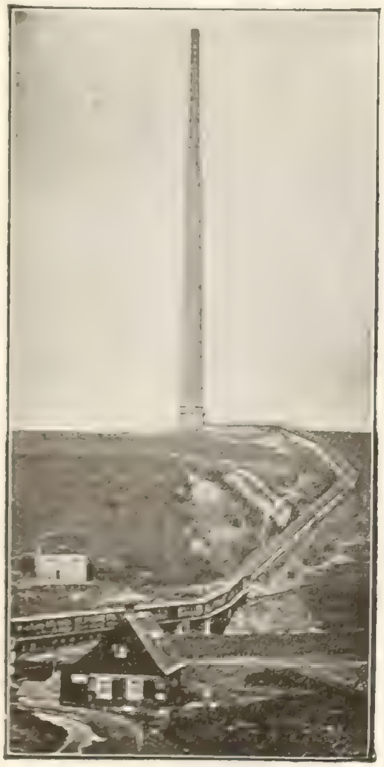

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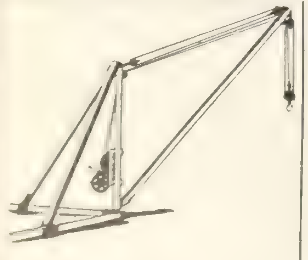

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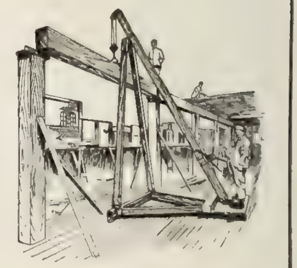

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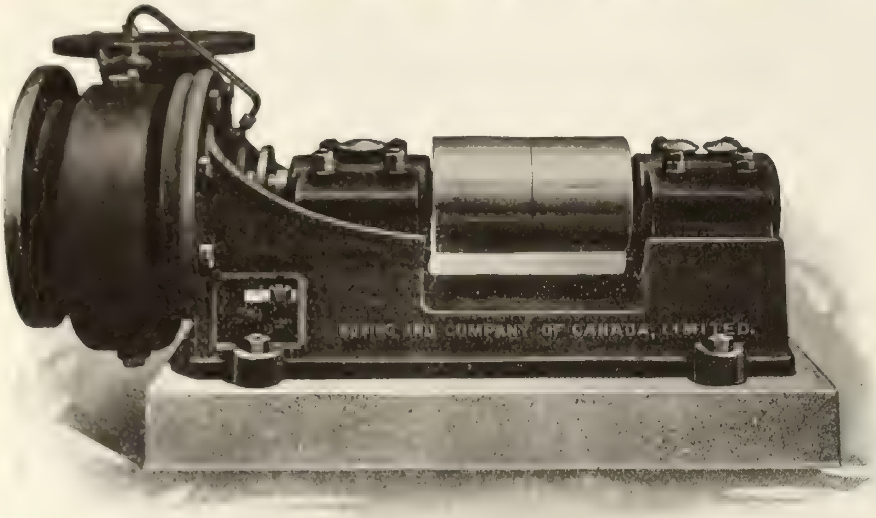

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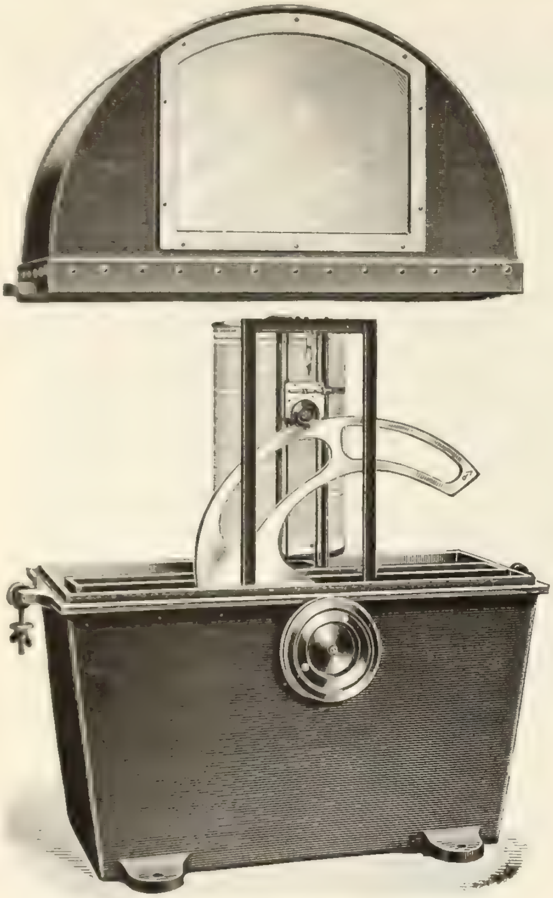

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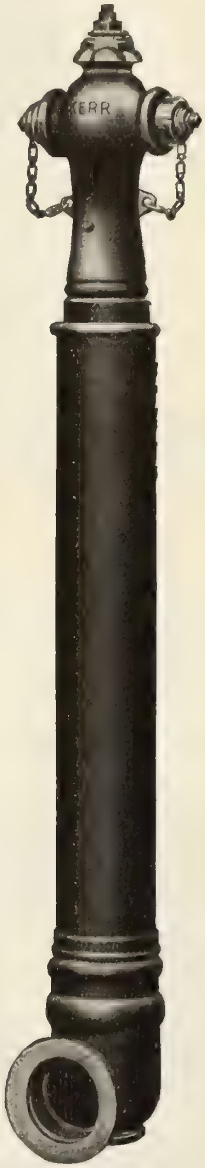

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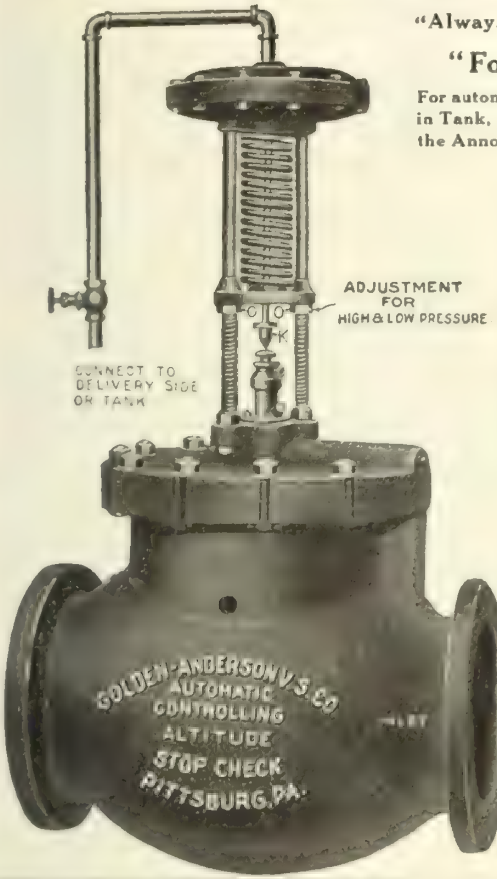

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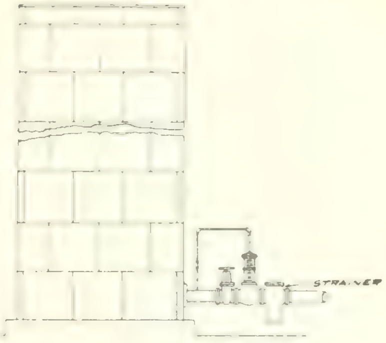

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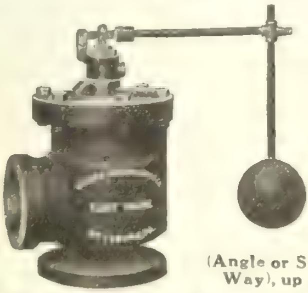

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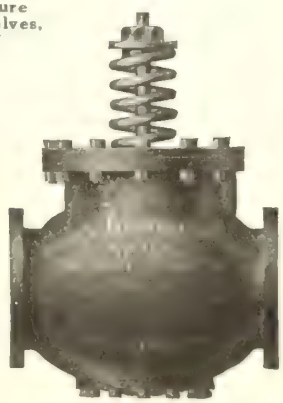

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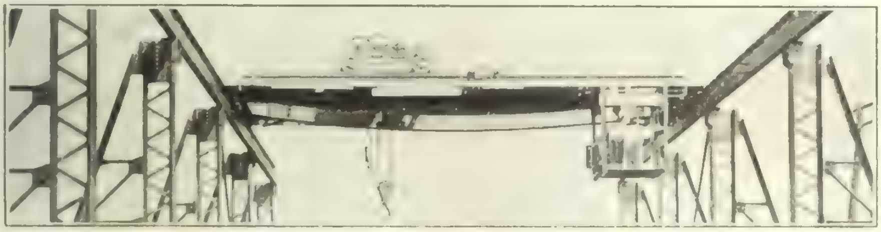

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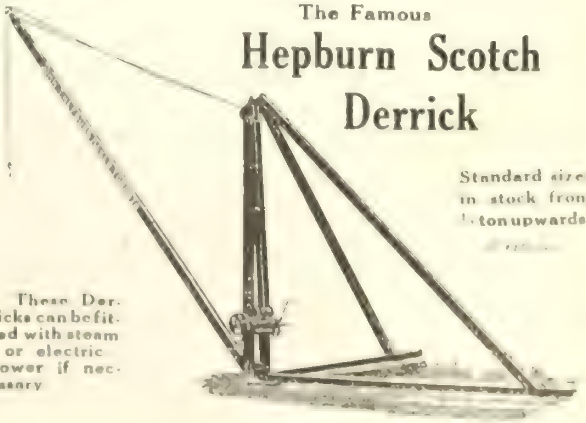

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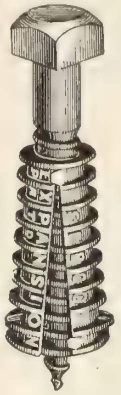

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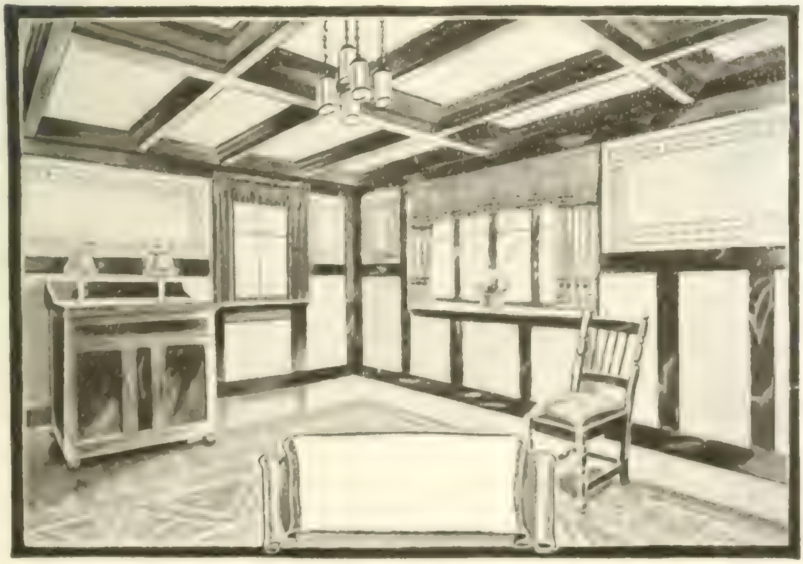

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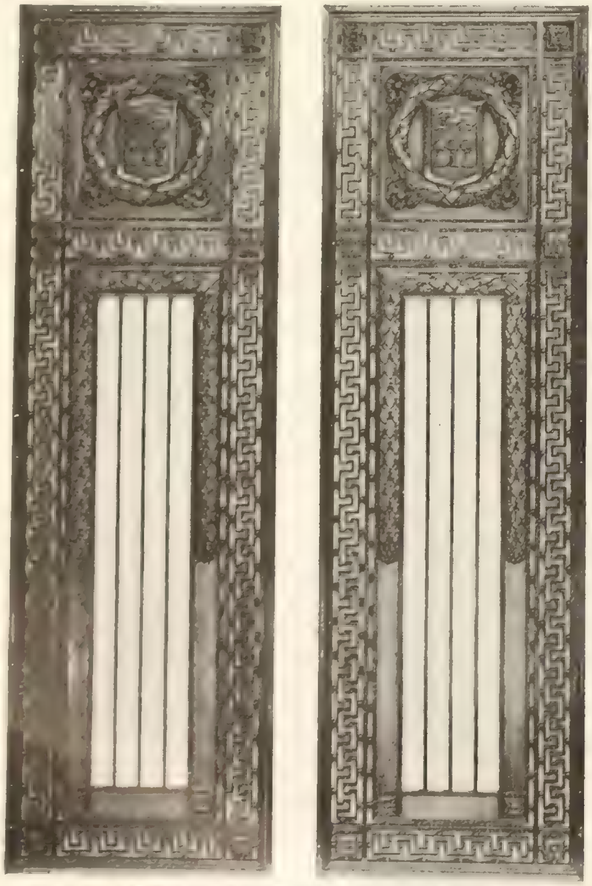

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ESTABLISHED 1886

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HUGH C. MACLEAN, LIMITED
HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
HEAD OFFICE - - 220 King Street West, TORONTO
Telephone A. 929

MONTREAL - Telephone Main 2299 - 119 Board of Trade
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LONDON, ENG. - - - - - - - - 3 Regent Street, S.W.

SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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British Trade in Canada

TRADE Extension Over-Seas was the topic of an article published in our issue of August 20 last, in which we considered the conditions under which business between Canada and Great Britain was being carried on. In this article we included among the constructive factors the interchange of visits by responsible business men, a careful reconnaissance of the Canadian field by one of the principals, and the appointment of enterprising, reliable agents. We arrived at the conclusion that there was vast scope for further effort on both sides.

We make this mention of our previous article preparatory to enlarging upon points contained in an address by Mr. C. Hamilton Wickes (H. M. Trade Commissioner in Canada) before the London Chamber of Commerce last month.

It is a matter of gratification to find the outline of trade conditions given by Mr. Wickes, together with his description of the characteristics of the Canadian market, along lines parallel to those upon which our observations were laid down last year.

A matter which received careful attention at the hands of Mr. Wickes is the currency question. On more than one occasion we have deplored the action of British manufacturers in maintaining the practice of sending out catalogues and price lists containing quotations in English currency. This has been a source of much trouble to Canadian business men. In cases, owing to deductions allowed for discount and other charges, they have been obliged to consult the customs authorities on the question of adjustments. It is difficulties such as these that cause the Canadian agent to look upon British agencies with less favor.

Emphasis is given by Mr. Wickes to the objection that Canadians have to waiting two or three months for their goods. This is a point that may well be committed to heart by a number of British firms of our acquaintance, but at the same time there is undoubtedly considerable misconception on this score. It must not be taken for granted that all the advantages of delivery and freight are with the United States firms. Mr. Wickes expresses the opinion that there is little difference in the freight cost or in the actual time taken in delivery between British ports and United States factories to, say, Montreal and western points. We venture to add that often much of the difference that has undoubtedly existed in cases has been due to the lack of that enterprise which the spirit of competition has engendered in our friends across the border.

In regard to the distribution of goods in Canada, which must necessarily be attended with considerable expense, the Commissioner suggests the advisability of manufacturers combining to share the expense of opening up the market. Such co-operation would be especially feasible in the case of manufacturers of similar but non-competitive articles.

No consideration of trade conditions between the two countries would be complete unless special attention were given to the matter of agencies and we are interested to find that Mr. Wickes deals carefully with this subject. In our previous article we commented upon the absurdity of placing a man in the Canadian field and restricting his operations by the allowance of limited means. Too often British firms fail to realize the large expenditure needed for an agency in Canada; too often the sum they allow their agent for travelling expenses is wholly inadequate.

The final point brought out by Mr. Wickes in regard to agents touches upon the inadequacy of the efforts made on behalf of British firms. Mr. Wickes is authority for the statement of instances where agents have absolutely neglected the business of old country firms with the result that it has been found necessary to change the agencies and send representatives direct from England. This is a point around which there might well be profitable discussion.

Herein, perhaps, lies the secret of many difficulties attendant upon British-Canadian trade — **agencies.** When placed in Canada, they are frequently **mis**placed; when a representative is sent from headquarters, too often he has not the qualifications or executive ability to make the most of his opportunities. As we pointed out previously, Canadians are apt to estimate the character of the home industry by that of the man with whom they have to deal in their own country.

Canada is a land of great opportunities, but the prizes offered to those who strive and prevail in her constructional development are not to be easily won. They are worth the winning and they will be offered for the best service, irrespective of whether that service come from Canada, the United States or Great Britain. In this competitive age, cost, efficiency and time are factors of paramount importance. The purely sentimental regard that the British have for the British is a matter of small count when it comes to dollars and cents—and service.

We take pleasure in complimenting those who are striving to improve trade relations between the mother country and the Dominion, feeling confident that considerable success must attend their efforts—provided the theories propounded give way to practice.

Concerning One-Sided Contracts and their Fulfilment

HAPPILY, or unhappily, legal decisions in the United States are not based upon the code by which we are governed in Canada. In many respects British law is widely at variance with the ordinances by which our neighbors to the south live and have their being. But there are cases in which legal decisions and legal observations find a common level. A case in point is a statement of the Missouri court, which runs as follows: "A man in possession of his faculties and able to read should be bound by what he has signed, even though he did not know what it contained when he affixed his signature."

This subject has recently been the topic of discussion in the American Society of Engineering Contractors and many good points have been made. We cannot but join with the Society in deploring the fact that notwithstanding the great development of the contracting business during recent years there are many contractors, otherwise able and experienced men, who display an astounding lack of knowledge of the law as it relates to contracts. They cheerfully sign contracts by which they barter away their rights to arbitration, and go even to the extent of depriving themselves of the right to appeal to the courts. Contractors secure their final estimates and go, new machinery is invented and construction methods change, but there still survives the old form of contract devised many years ago when the contractor was employed practically by the day. In those times the ordinary contractor was to all purposes a mechanic. He had little capital, small plant investment and few overhead expenses. In many cases he charged so much a day for his men and the difference between his charges and the wages paid was his only profit. His risks were small, he had little to lose, and consequently the contract was not reasonable, because the loss, if any, would fall almost entirely on the party for whom the work was being done. It is different nowadays. Contracting has developed into one of the larger businesses of the country. Millions of dollars are invested in it and thousands of people get their living from it. And yet there are many contractors, good practical men, capable of handling work involving great sums of money, who display a woeful ignorance regarding the law of contracts on which the success of their business depends. The pitfalls into which the contractor is liable to tumble through his carelessness in signing one-sided contracts are legion.

In an address before the National Building Trades' Association, Mr. Charles Carroll cites cases to show the absolute necessity of carefully inspecting every contract to see that the rights of both parties are protected, and emphasizes the fact that no contractor should enter any contract by which he barters away his right to arbitration or which deprives him of his rights to resort to the courts of the land to receive justice. He concludes:

> It ought not to be difficult in this day of thorough organization and thorough knowledge of the details of construction to prepare a contract covering in detail all points of the work and to define them so plainly and so explicitly that there cannot be any controversy as to the meaning of the contract document. The contractor owes it to himself, to the company that becomes his surety for the proper construction of the work, and to his family, that all of these points be so covered in the contract that no controversies can arise concerning them, and it should be provided in the contract that in case of dispute between the contractor and the architect or owner concerning the proper construction of the work where there is a material question involved this question should be submitted to arbitration, composed of disinterested persons selected by each side. In this way each party can have the satisfaction of knowing that this case will be passed upon by an impartial tribunal. One of the parties cannot then have the satisfaction of knowing that the question in dispute will be determined by a judge who has been committed from the beginning and who is personally interested on one side of the question.

Frequently we hear that some contractor has tried to evade the terms of his contract upon discovering that he was accumulating a loss on the work. His excuse is liable to be that he did not read the contract before he signed it. Once a contract is signed it is binding on both parties thereto irrespective of their lack of knowledge, respecting its terms.

One-sided contracts would cease to exist if contractors did two things. In the first place they should read their contracts before signing them and, even better, let a competent attorney advise them. Secondly, together with engineers and others interested in contract work they should organize a powerful organization and draft agreements equitable and fair to both parties. Then they might insist on standard contracts.

The Requirements of the Municipal Engineer[*]

By H. N. Ruttan[†]

ENGINEERS do not occupy that place in the public eye to which their education, practical knowledge and ability entitle them. One reason for this is that they are retiring and modest and so abhor the loose theories and statements of laymen on engineering questions that they have a desire only to be left alone and be allowed to go ahead with their work in peace. In the interest of the public, as well as of the engineers, the time has come when the latter should assert themselves and take that place in the discussions of public matters of engineering for which their superior knowledge fits them.

Their influence may best be used in public speaking, in articles written for the press, and, probably more than in any other way by candid expressions of opinion to their personal friends.

The engineering profession, and every profession for that matter, is in a state of development, and it is most important that engineers should be posted as to the exact state of progress made and being made in, at least, the particular branch of the profession adopted by them, in order that they will be able to deal quickly and certainly with proposals brought before them, so that it will not be necessary to make tedious and exhaustive comparison and tests to determine what should be done. Let me illustrate this by a practical example.

An imaginary town in the west wishes to install a waterworks distribution system consisting of, say, ten miles of mains. The news of this is published in the technical papers, the town is at once flooded with manufacturers' agents representing many types of pipe, among which are cast iron, wrought iron, sheet steel, and wood stave of various designs. Now, each of the agents maintains that his pipe is much the best, and that while he does not wish to "knock" his competitors, it is plain to anyone that Smith's pipe should be ruled out for one reason, and Brown's for another, and Smith and Brown say the same about their competitors. What, under these circumstances, is a poor municipal council to do? The Councillors all wish to be good fellows to the agents, who have treated them so well, and taken the discussions with such good humor. They are charitable enough to conclude that all the pipes are good. They do not wish to show favoritism. They are fair men. Therefore they decide they will take two miles of pipe from each of the five agents.

The engineer of the council has not, perhaps, had many years' experience. He has always seen cast iron pipe used, and he mildly suggests to the council that it would be safe to use that pipe. He is not in a position to talk down the salesmen and show up the defects of their respective pipes, because he has not fully posted himself from the experience of other places, and unfortunately the pipe which he thinks least of is represented by that brilliant story-teller, mine of useful information, and all-round good fellow, Jerry Squarehim.

"Pouf!" says Councillor Goodenough, "if the engineer had objected to some of the other pipes, there might have been something in his objection; but to object to Jerry's pipe—Pouf! ! ! Besides, our best plan is to try all the pipes and then we will know which to buy next time."

I won't take up your time explaining the engineer's trouble in laying the pipes. How some of the tenders did not include cast iron specials for the intersections, which involved additional expenditure; how the joints leaked; how the protecting covering of others was abraded in making connections, and how the pipe was eaten out in a few years by acids in the soil. All these things are written in the account book of the now flourishing little city, but they are much too dry reading for the only people interested—the taxpayers.

I have told you this imaginary (?) story in order to impress upon you the absolute necessity of keeping abreast of the times, of knowing and taking advantage of the experience of others, of being in a position to say to your employers: "I do not need to experiment in such a case. I know from the experience of Messrs. Smith and the city of Blankville, that the pipe has not been satisfactory for such and such reasons." Even explicit statements will not always prevent your employers from having their own way, but you will at least have done your duty, and the responsibility will be upon those who disregarded the advice of their own paid official. Unfortunately, the public never attach any responsibility to the members of the council in such a case. They invariably want to know who the engineer was.

Haste in Building

THE modern tendency toward haste in building construction appears to have reached its consummation in the recently reported feat of erecting a two-and-one-half-storey residence, from the cellar excavation to the final plaster coat, within twenty-four hours. From three to four hundred men were employed on the premises simultaneously and every time-saving device known to the builder's trade was utilized. In accomplishing this unusual enterprise the contractors must have had very much the same sensations that an architect feels in attempting to perfect designs for a prospective building within the time allowed by an eager client.

When an experienced business man urges that building operations be started, by contract, on a large apartment house within three weeks from the making of the first sketches, there is good opportunity for the architect to do some much-needed educational work. To tell his client the truth at the outset rather than entirely evade the issue will forestall much ultimate disappointment on the part of the owner and relieve the architect of the odium that attaches to supposed tardiness. To take an inexperienced client "behind the scenes" and give him some idea of the amount of time needed for perfecting the details of his commission is missionary work worthy of a busy architect's consideration, for it may dispel the popular idea that the work is principally pictorial and may be readily done by a clever draftsman in a few hours.

Very few things worthy of perpetuity in art or architecture have been accomplished when speed was the controlling factor. Doubtless the ceiling of the Sistine Chapel could have been decorated within six months, but Michael Angelo would not have cared to sign it as his own. The artist's or architect's function is creative, and such creativeness generally cannot be hurried if the best results are to be gained. The use of mechanical contrivances for lessening the labor of building operations, and the rendering of skill in the drafting room more efficient by wise organization, are legitimate and generally desirable, but to allow too short a time for creating the design or directing the work is to render uncertain results which might otherwise be thoroughly satisfactory. When the exigencies of the case demand, as in the recent erection of a notable bank building in New York, architects have frequently shown a spirit of accommodation in accelerating the work that was equalled only by the excellence of its performance. It is unreasonable, however, for a client to ask an architect to do every day that which is justified only in emergencies.

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[*] Extract from an address to Winnipeg Engineering Students.

[†] Retiring City Engineer of Winnipeg.

Footings, Eccentric and Concentric, and Resulting Soil Pressure

Specially contributed by W. Muir Edwards, M. Sc., Professor of Civil Engineering in the University of Alberta

SAND versus rock as the sub-base for a structure has been a familiar parable to many generations. Contemplating the complete destruction of the house built on the former "when the floods came and the wind blew and beat upon it" whilst its rock-bedded neighbor successfully withstood the onslaught, we may have formed an extremely poor opinion of the suitability of sand as a material upon which to build. Were our structures called upon to resist flood as well as wind this is undeniably true, but should the requirement be only that of supporting a direct load, as is the case in the majority of foundations, then we must readjust our scale of values and place sand quite high when rating the bearing power of soils.

Upon just what basis then are we to judge the bearing power of a soil, and how may we arrive at its capability in this regard? The theoretical solution of the problem involves the theory of conjugate stresses and assumes that the soil is a homogeneous granular mass without cohesion amongst its particles, and that for each material there is a certain angle of repose ϕ (i.e., the maximum angle of inclination at which the free surface of the material will stand). These conditions, of course, do not occur in practice, but such an investigation gives us a means of comparing different soils, and the results obtained by theoretical reasoning are on the safe side, so far as the ultimate pressures are concerned. It neglects, however, the very important fact that compression of the earth may take place under the load and hence undue settlement occur in developing the full resistance of the material.

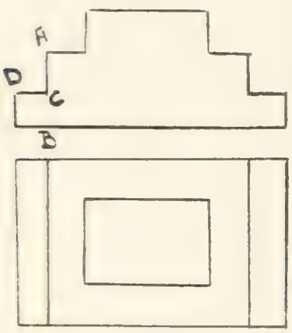


Fig. 1

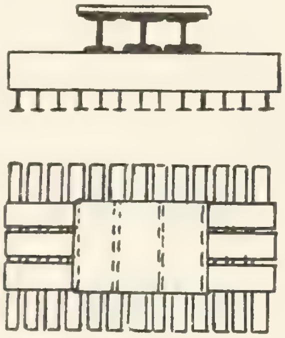


Fig. 2

The formula giving the theoretical resistance of the material to the applied load is

$$p = wh \left\{ \frac{1 + \sin \phi}{1 - \sin \phi} \right\}^2$$

in which w is the weight of a cubic foot of the material, h is the depth of the plane of pressure beneath the surface of the material, ϕ is the angle of repose and p is the allowable pressure. If w and h be in pounds and feet then p is in pounds per square foot.

As an example of the application of this formula we might take the pressure allowable at a depth of 3 ft. in a soil whose angle of repose is 30 deg. and whose weight per cubic foot is 90 lbs., then $p = 90 \times 3 \left\{ \frac{1 + .5}{1 - .5} \right\}^2 = 2430$ lbs., or about 1¼ tons per sq. ft.

It will be seen that the depth to which the foundation is carried is, according to the formula, an important consideration since the pressure varies directly therewith. In general practice, however, it will be found that it is usual to specify a certain bearing capacity for a given soil, no mention being made of the depth. The load allowed by the building by-laws will vary according to locality, the regulations usually stating a maximum load for given kinds of soil or requiring a certified test of the actual bearing power, which test must be reported to the building inspector. The allowable loading per square foot for different soils is, as has been said, of a somewhat arbitrary nature, but is usually considered as being about as follows (The values are taken from Merriman's Civil Engineer's Pocket Book):

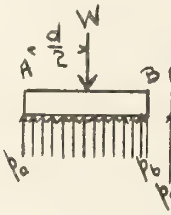


Fig. 3

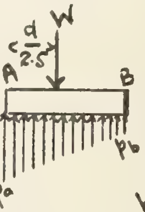


Fig. 4

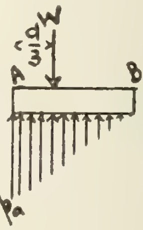


Fig. 5

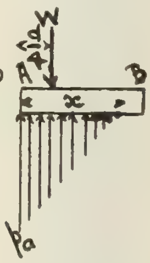


Fig. 6

Clay—in thick beds always dry, 6 to 8 tons; in thick beds moderately dry 4 to 6 tons; soft, 1 to 2 tons. Sand—dry, compact and well cemented, 4 to 6 tons; clear, dry, 2 to 4 tons. Alluvial soils, etc., ½ to 1 ton.

In regard to the value of ϕ used in the theoretical investigation 27 deg. would be a minimum value for a firm soil and 45 deg. might be taken as a maximum value for material fulfilling the conditions upon which the assumptions are based.

Footings

The allowable pressure on the material of which the foundations are composed is, of course, much higher than the above. For 1:3:6 concrete, for instance, the crushing load might run 125 to 150 tons, and for medium brickwork a safe load is from 5 to 10 tons. It is thus necessary to distribute the load carried by columns or walls over larger areas than their own cross-section before it is transmitted to the soil. This is done by widening the area of the footings by successive steps, until the required bearing surface is obtained, or by using a grillage of beams by which the concentrated load is gradually distributed.

In Fig. 1 is shown the plan and elevation of a stepped footing and in Fig. 2 a plan and elevation of a grillage. In the stepped footing the widths and depths of the steps must be calculated considering the footing as a beam subjected to a uniformly distributed load on its under side.

In Fig. 1, for instance, using a safe bearing of 2 tons per sq. ft., the BM at the section AB, considering a 1-foot strip of the wall, is $4000 \times X \times X/2 = 2000X^2$ foot-pounds. This must be opposed by the moment of resistance of the section CB. The depth of the course CB will thus govern the width of the step CD.

In a grillage of steel I-beams the calculation of the developed stresses is somewhat more definite. The beams forming the under grillage are calculated as double cantilevers carrying a uniformly distributed load on their under side.

Eccentric Footings

Given the safe bearing power of the soil it is a comparatively elementary matter to calculate the safe central load that may be applied to any given foundation. Should the load be not central, however, the intensity of pressure on the soil is not given by dividing the total weight by the bearing area.

It is somewhat difficult to say with exact precision just what are the reactions which take place between the foundation and the soil upon which it rests, but it is quite evident that since there is stability the resultant of the soil pressures must be axial with and equal in magnitude to, the resultant of the foundation loads.

Considering Figs. 3, 4, 5 and 6, let R be the resultant of all the resistances offered by the soil. Then R and W must be equal, opposite and in the same straight line.

It is obvious that there must be a gradual change in the intensity of pressure and it is assumed that the change is uniform (i.e., ab is a straight line). Let p_a and p_b be the intensity of pressure at A and B respectively due to a load W applied as shown. In each case, since ab is a straight line

$$R = \frac{p_a + p_b}{2} \times AB = \frac{p_a + p_b}{2} \times d.$$

Also p_a and p_b must bear such a relationship that R, the resultant of all pressures, must always be in line with $\overline{W}$ the resultant of the applied loads.

If $\overline{W}$ be the load per lineal foot of the foundations and d be the width of the foundations in feet,

In Fig. 3 $p_a = p_b = \overline{W}/d$.

In Fig. 4 there are two equations to solve for p_a and p_b; these are (1) since $\overline{W} = R$ then $\frac{p_a + p_b}{2} \times d = \overline{W}.$

and (2) since $\overline{W}$ and R are concentric

$$\frac{[illegible]}{2}\,\frac{[illegible]}{3} + \frac{[illegible]}{2}\,\frac{[illegible]}{3} = \frac{[illegible]}{2}\,\frac{d}{2.5}$$

Solving these $p_a =$ [illegible] $\left|\frac{\overline{W}}{d}\right|$ and $p_b =$ [illegible] $\left|\frac{\overline{W}}{d}\right|$

In Fig. 5 if we solve we will find that $p_a = 2\frac{\overline{W}}{d}$.

and that $p_b = 0$.

If we apply the same reasoning to Fig. 6, p_b would be a minus quantity. It is obvious that the earth cannot exert tension on the foundation and therefore there is a non-continuity at this point and cases represented by Fig. 7 are solved by the assumption that as before R = W and is concentric with it, and that the intensity of pressure varies from a maximum to 0, as a minimum. "x," the width of the foundation exerting pressure, under these assumptions, must in this case satisfy the equation [illegible] and the maximum intensity of pressure p_a is given by the equation

$$\frac{p_a}{2} \times \frac{3}{4}d = \overline{W}.$$

$$\text{or } p_a = \frac{4}{3}\,\frac{2\overline{W}}{d} = \frac{8}{3}\,\frac{\overline{W}}{d}.$$

If, then, $\overline{W}/d$ is the allowable intensity of pressure for a given soil, the eccentricity of the loading would not only make an unequal loading on the soil (in itself an extremely detrimental result) but would give a maximum intensity of soil pressure 2 2/3 greater than the allowable amount.

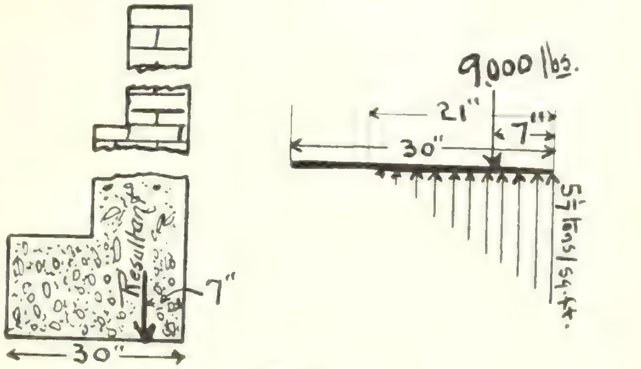


Fig. 7

It would seem that such results would not obtain in practice. On the contrary, however, they are responsible for many of the unsightly settlement cracks seen in buildings and in many cases the neglect of this factor of eccentricity has led to the total destruction of the structure.

One very common occurrence of eccentric loading is the widening of the foundation under a party wall to obtain the required area, entirely on one side of the property line.

For instance, a five-storey concrete and brick wall, 16-in. for the first two and 13-in. for the balance, might weigh 9,000 pounds per lineal foot of wall and the centre of the applied loads lie 7-in. from the outside face of the wall.

As shown in Fig. 7, the width of wall required for a soil bearing a load of 2 tons per sq. ft. under a centrally-placed load of 9,000 pounds is 2½ feet or 30-in. But should such a width of footing be put in the actual distribution of stress in this case will extend over only 3 x 7 = 21 inches instead of the total width of a 30-in. and the maximum intensity of pressure will be given by

$p/2 \times 21/12 = 9000$, or $p = 24/21$ of $9000 = 5\ 1/7$ tons per sq. ft.

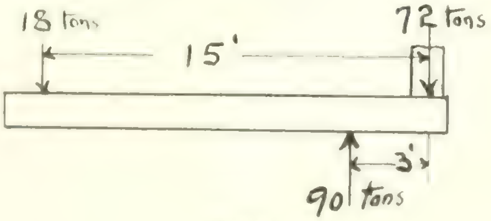


Fig. 8

In the above not only is there an excessive intensity of pressure but since there is such a great variation in the intensity the outside of the footing would have a much greater tendency to be driven into the soil and thus there would occur an outward turning moment on the wall.

Constantly there are cases where it is necessary to erect structures such as party walls and several methods may be adopted to provide suitable foundations. All of these should look to (1) a uniform distribution of the load to the supporting soil and (2) that the safe bearing power of the latter is not exceeded. Two of these methods might be mentioned—(1) a cantilever footing, (2) pile foundations.

Cantilever Footings

As the name implies, a cantilever footing carries the load on the end of a lever, the upward thrust at the other end being suitably provided for and the reaction of the fulcrum being carried to the soil in such a manner that the safe bearing power will not be exceeded. The case discussed in Fig. 7 might be outlined as follows, assuming that the wall is carried longitudinally in bays of, say, 16 feet, and concentrated on the end of a cantilever.

Referring to the diagram in Fig. 8 it will be seen that if the cantilever be 15 feet in length and the fulcrum be 3 feet from the 72-ton load, then the load on the other end required to just balance the 72 tons would be 18 tons and thus the load on the fulcrum would be 90 tons. If the allowable bearing on the soil beneath the footing is 2 tons per sq. ft. we would require 45 sq. ft. as the area for the base of the supporting pier. In addition to the wall load here provided for there would be other loads, such as the floor load, the live load and the wind load, to take into account. These would increase the load on both ends of the cantilever and thus the required bearing area might be larger than 45 feet. By suitable design, however, the fulcrum load may be applied centrally and the required area for the footing obtained within the property line.

Piling a soil increases its bearing power in two, and possibly three, ways: (1) it tends to compact the soil; (2) it transfers the load to a much lower plane, so far as the soil is concerned, and hence applies the load at a point where the allowable pressure is much higher than near the surface; (3) there is a very great increase in the resistance of the pile as compared with the earth which formerly occupied the same space, due to the friction between the surface of the pile and the earth into which it is driven. This latter quantity is a considerable amount and accounts for the much higher pressure that piled ground will carry. The piling thus increases the value of the allowable intensity of pressure. In the case already cited in Fig. 7, if we wish a central load the available width for the footing is 14-in. and hence the resistance of the soil must be brought up to 9000 x 12/14 = 7714 pounds per sq. ft., i.e., a bit under 4 tons per sq. ft. As in the case of the cantilever footing this would be increased by the loads not here considered.

As has been said, the whole stability of any structure is dependent in the first place on the efficiency of its foundations. If reliable data is not available, tests of the bearing power of the soil should be carried out. Careful design requires not only a maximum intensity not in excess of the safe bearing power, so determined, but should also insist on uniform intensity of pressure throughout the foundations. The latter is as important as the former, uneven settlement being the cause of the majority of foundation failures. Too often great care is expended in beautifying, in fireproofing, or on some other feature in design, and the foundations are slapped in by rule-of-thumb or by no rule at all; but they require and should receive as much careful design as is given to the part above ground. Although out of sight the foundations are certainly one of the most important features of the structure.

Dunn Wire-Cut-Lug Brick

In our report of the Montreal Road Congress, published in our issue of May 27, there were a number of erroneous statements concerning the Dunn Wire-Cut-Lug Brick Company which call for correction. We referred to this company as "among the most important manufacturers of paving brick in the United States" and as having "the largest continuous kiln in the world," whereas the company does not manufacture brick, but is a licensor of manufacturers. The kiln is owned by the Bessemer Limestone Company, of Youngstown, Ohio, who had a joint exhibit with the Dunn Company at Montreal. The announcement that the Dunn Wire-Cut-Lug Brick Company license the manufacture of wire-cut- lug brick has been made repeatedly in the advertising columns of this journal and we are pleased to emphasize the fact editorially.

An Important Terminal Scheme

The province of Ontario is undertaking an important development in establishing a terminal port at Moose Harbor. One of the features of the scheme is a 185-mile extension to the Temiskaming & Northern Ontario Railway at a cost of some five million dollars.

The most advantageous location for the proposed terminal so far as present information goes is at the mouth of the Moose River. The distance from this point to Toronto is approximately 670 miles. The first definite information concerning the locality was obtained by engineering parties sent out in 1911, which made a complete instrumental survey of the estuary during that season. It was found that Moose Harbor provides an excellent site for the creation of a great port. The estuary is perhaps 20 miles long and varies from 1½ to 3 miles in width. It is crowded with islands, and through the intervening channels there discharges a river, which so far as known, was never smaller than the Ottawa River. The settlements and fields on the islands have been long occupied and the flat-lying shores provide an ideal site for a rail and water terminal.

The surveys of 1911 showed that the river was divided into two great channels and that the depth of water in these channels varied to such an extent that their improvement would be expensive. Further on, however, these channels form into one broad and deep waterway, bordered by very extensive sand bars. The depth of water in the main channel varies at low tide from 15 ft. to 20 ft. but the fairway is cut off from the main bar by a bar having a total width of about 4 miles and a minimum depth of water of 6 ft. Beyond the bar the depth of water steadily increases until at a short distance out soundings are secured that are satisfactory for any probable navigation.

It is not believed that traffic conditions will justify the construction of a channel of more than 15 ft. depth at low water. The excavation of a 300-ft. channel of this depth out to the bay should cost in the neighborhood of $600,000. It is believed that in the earlier years of its development no better plans can be made for Moose Harbor than those that have worked successfully for so long in Montreal. There is an excellent site on the north shore of the estuary, extending from the port of Rivillon Freres to the head of Sandy Islands for a development on the Montreal principle. The channel in front of this shore is of satisfactory depth and the lands behind it have the proper contour for an efficient railway yard. The cost of the 1,000 ft. of crib wharfing at this place may be estimated at approximately $150,000.

The work that has been done up to date has proved beyond question that the construction of a deep water terminal at Moose Harbor is perfectly feasible, and that it does not involve more than a very moderate expenditure. It may further be stated that the exploratory surveys for the railroad extension from the present terminus at Cochrane to the harbor are so well advanced that this portion of the undertaking is known to be a piece of railway construction of the most ordinary type. It is therefore probably only a question of a short time before the Provincial authorities will take up the extension of this railway and the construction of terminal facilities on James Bay.

Modern Refuse Disposal Practice at Halifax, N.S.

THE council of the city of Halifax, realizing the danger and annoyance caused by the old system of dumping the waste collected in the city, instructed their engineer, Mr. F. W. W. Doane, to prepare specifications for a modern disposal plant to dispose of this waste in an economical and sanitary way. These specifications were drawn, calling for a high temperature destructor capable of burning to an innocuous inorganic ash fifty tons in twenty-four hours of the ashes, garbage, combustible rubbish, manure, carcases and night soil as collected.

The Griscom-Russell Company, of New York, American representatives of Messrs. Hughes & Sterling, of London and Liverpool, prepared plans and specifications for a Sterling refuse destructor and Messrs. Dongard Bros., of Halifax, N.S., were awarded the contract for the construction of the plant in accordance with the plans submitted. The contract price for the entire plant was $41,775.

The plant consists of a two-storey reinforced concrete building, absolutely fireproof throughout. Access for the collection wagons to the second storey or receiving room is by means of a long inclined wooden runway. The collection wagons empty their contents in the receiving room into a large steel storage hopper, which is designed to hold the collection for an entire day. The receiving room has two wagon doors, so that when a wagon is emptied it can pass through the side door to an extension of the runway without blocking the entrance of other wagons into the receiving room.

Through doors in the bottom of the receiving hopper the material to be burned falls into steel containers, of which there is one over each furnace cell. The operator working on the charging platform keeps these containers filled and when the foremen desire, one is released and discharges its contents into the furnace below. The releasing mechanism may be operated from the charging platform or from the furnace room floor. The combination of this swinging container and quick opening furnace cover forms a simple and satisfactory method of mechanical charging.

The destructor furnace consists of three standard Sterling cells and a common combustion chamber. Each cell has an ample drying hearth. All surfaces exposed to the high heat are protected by a 9-in. wall of fire brick blocks. This fire brick is of a special grade, thoroughly tested to withstand the severe service. The furnaces are heavily stayed and reinforced by steel and iron plates, beams and tie rods. The grates are of the special Sterling pattern surrounded by massive air-cooled castings which prevent injury to the brick work when stoking or clinkering.

Halifax disposal plant, showing chimney and runway.

From the combustion chamber the gases pass through a 200 h.p. Root water tube boiler and then through a steel tube regenerator, where the air for the forced draught is heated. From the regenerator the gases pass to a 115 ft. radial brick chimney lined to the top with fire brick.

A bypass connects the back of the combustion chamber with the regenerator and chimney, so that by

Charging floor. Front of container

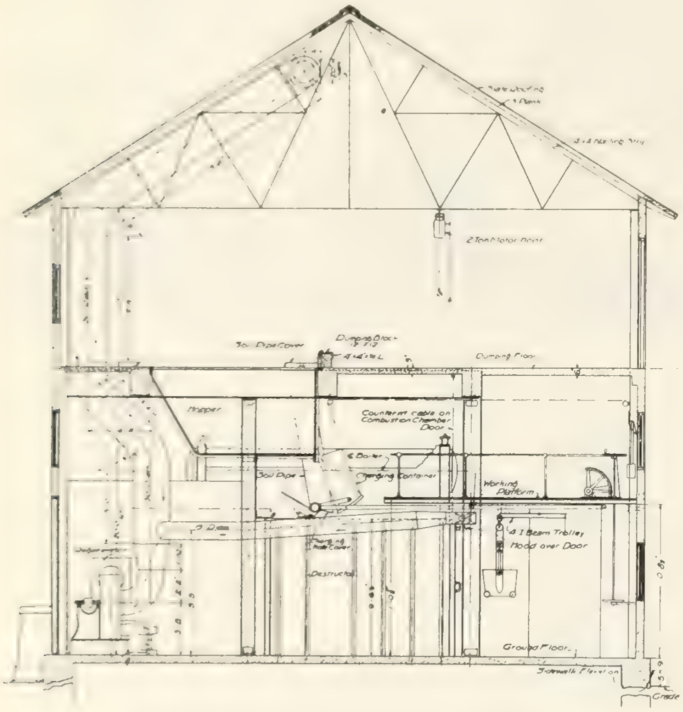
Rear of cells. Engine and fan for forced draft

adjusting dampers it is possible to cut out the boiler and send all or a portion of the gases through the regenerator, the remainder passing to the chimney.

The bottom of the combustion chamber is a deep sloping hearth on to which the night soil is delivered from a steel chute running to a manhole in the receiving room floor. The intense heat in the combustion chamber soon evaporates the moisture and burns the organic matter in the night soil without the slightest odour, leaving an inoffensive mineral residue.

The building is thoroughly ventilated and kept free from smoke and dust by a combined ventilation and forced draught system. An engine-driven fan draws the air through steel ducts from the charging floor and from the front of the furnace, delivering the foul air to the regenerator, where it is heated by the waste gases and conducted to the ash pits under the grates. The amount of draught is regulated by a butterfly valve in the hot air pipe line to each cell.

The plant is lighted by electric generator and a direct connected steam engine using stem from the boiler. A number of arc lights are placed on the runway and in the yard and building these being supplemented by numerous incandescent lamps.



Halifax disposal plant. Section through building.

The clinker, as it is drawn from the furnace cells, falls into a large steel bucket, which runs on a monorail crane. This crane rail extends into the yard where the clinker is dumped and allowed to cool. A rotary crusher, with screen and elevator, is installed to crush the clinker for use in sidewalk slabs, concrete work and road making.

A Brown electric pyrometer is installed to record the temperature in the combustion chamber. A Simmance-Abody combustion recorder is installed to analyze and record the amount of carbon dioxide in the gases of combustion. A Bristol recording gauge makes a record of the stem pressure.

On official test, March 8, 1913, the destructor burned at the rate of seventy tons in twenty-four hours, exceeding the guarantee by forty per cent. The material burned consisted by weight of 75 per cent. unscreened ashes, 16 per cent. wet food refuse, or garbage, and 9 per cent. combustible rubbish and refuse. The ashes to be burned were mostly from house furnaces and closed stores and were very low in calorific value. This was shown by screening a sample, when 45 per cent. passed through a fine screen.

The average rate of burning during the test for the three cells was 77.7 pounds the square foot of grate surface an hour. One cell burned at the rate of 89 lbs. the square foot of grate surface an hour.

The evaporation in the boiler was 1.53 lbs. of water F & A 212 deg. F. for each pound of material burned. Thus 258 boiler horse power an hour was being generated. The average boiler pressure was 145 lbs.

The average CO_2 was 9.94 per cent. The average temperature in the combustion chamber was 1357 deg. F. The average interval between clinkering was 92 minutes. The average time to clinker was 8 min. The operating crews consisted of three men and one extra helper during the day shift. The specified wages were 30c and 17c an hour. This gave a labor cost of 28c a ton.

At another period the residue from the furnaces was carefully weighed and 22.8 per cent. of the material burned was converted into very hard vitrified clinker suitable for crushing.

This work is now being carried on in Canada by the Canadian Griscom-Russell Company, Limited, 736 St. Paul Street, Montreal.

In laying out construction work, lines are usually strung between batter boards. Some contractors use wire for the main lines and find it satisfactory. A light wire, about 18-ga., can be used satisfactorily. The only trouble is that the wire rusts and is practically wasted, and some contractors might not consider its use an economy. On the other hand, on lines of great length, the wire stretches less and can be pulled so much more taut. An ordinary cord has to be taken in at night to both save it and to prevent it from shrinking and snapping in case of a rain. Wire, however, can be put up once and left up until its use for that particular line is past.

By keeping currents of several hundred amperes flowing continuously through water pipes which otherwise would have been in danger of freezing, it was possible to continue construction work on the hydro-electric development of the Cedar Rapids Manufacturing Company, near Quebec, without interruption during even the coldest days of the past winter. The 1-in. pipes thus protected supplied water for the steam shovels and were laid above ground, as continuous shifting prevented them from being buried. Current for the pipe circuits was obtained from a bank of transformers stepping down from 2,300 to 220 and 110 volts. The pipe connections consisted of copper wires wound around the ends of the pipes and buried several feet in the earth to prevent the pipes from freezing below the connections. When the temperature was below zero, and even as low as —27 deg. Fah., it was found that 40 kilowatts at 220 volts would keep 1,500 ft. of 1-in. pipe from freezing, even with water standing in it. A 1,000 ft. pipe required 20 kilowatts at 110 volts.

A concrete buoy has been constructed at Kingston, Jamaica, at about one-half the cost of a steel buoy. The bottom is made concave so as to protect the eyebolt from the mooring chain. Reinforcing bars are used, and the total weight is about five tons.

Concrete Roads versus Foundations

Use of Concrete as a Surface Material Under Horse and Automobile Traffic — Advantages and Disadvantages — Difficulty of Repairing

By Major W. W. Crosby

FOR the sake of making clear the statements to follow, let it be assumed primarily that a concrete road is one in which the artificial surfacing for the roadway is built of a concrete composed of hydraulic cement, sand and gravel or broken stone, all of predetermined proportions, and is not covered, or protected from wear, by a carpet or coating of appreciable thickness of pitch and other material. Then all those roadways in which a cement concrete layer is covered by a carpet of pitchy material will naturally fall together into another class where a "concrete base" or "foundation" supports a wearing surface composed of block paving, sheet or rock asphalt, bituminous carpet, etc., and in the consideration of these instances of the use of concrete, the concrete will be referred to as the "concrete foundation." Further, it should probably be understood that in writing the following the author had in mind, when he referred to a road or streets, those public highways on which a considerable amount of animal drawn and of hard tired traffic might be expected along with motor traffic carried on rubber tires. In any case where the road crust is not open to use by an appreciable amount of the former traffic, some of the remarks made might have to be considerably modified.

The use of concrete for both road surfaces and road foundations is not new. Thirty or more years ago the concrete road (in the above described sense of the term) was "discovered," tried out and abandoned. It was found to possess certain inherent defects under the then existing conditions, and these proved so serious that its economical use was found to be limited so as to result in the practical abandonment of this form of surfacing for the time being. With the changed conditions now existing, the use of concrete for roadways has again begun. The increase of traffic has demanded stronger roads. The reduced ratio of horse-drawn to total traffic has changed the average character of the stresses on the surfacing material. The immense reduction in the cost of hydraulic cement and the improvements in machinery for mixing and placing the concrete have aided the latter to compete with other road crusts in first cost and also in long-run costs. And it seems to the writer that under the changed conditions there are at present many cases where existing circumstances—such, for instance, as poor natural foundation for and heavy traffic on the road, or convenience in the supply of materials for concrete—justify or even demand its selection for at least a part of the road crust. On the other hand, the tendency of certain road authorities and others to rush to concrete as a panacea for all road ills is to be deplored as both irrational and extravagant. In these days the great problem for road authorities is the proper selection of the form of construction best suited for the circumstances of any particular case, and a sufficient variety of surfacings, including concrete, is now available to permit true economy to be had by a proper choice.

Of the factors influencing the decision for or against the selection of concrete as the road surfacing may be considered: Cost (first and long-run), Durability, Ease of Maintenance, Cleanliness, Resistance to Traction, Slipperiness, Sanitariness, Acceptability, Favorableness to travel.

Cost—Only too frequently this consideration is limited to first cost and fails to include, as it should, the interest charges on first cost and the cost of maintaining the pavement in as good condition as when first completed (or a depreciation charge) in order that a fair comparison may be drawn. Concrete can never be as low in first-cost as macadam under the same conditions because of the introduction into the former of cement for which an additional cost has to be met. Ordinarily, though, competition may be had—often successfully—by a proper assumption that a less thickness of concrete will be as strong as the macadam to be prescribed, and further, that it is frequently possible to use in the concrete a local material for the aggregate which may be secured at a smaller cost than necessary for a proper stone for the macadam. A local granite may make an excellent concrete when it would prove entirely unsatisfactory, because of its lack of binding qualities, for macadam, and if macadam were to be built, the cost of importing a suitable stone might offset the additional cost of making concrete from the local granite.

In the same way, where small, sandy gravel is plentiful in a locality and good stone for broken stone macadam is required to be imported at a considerable expense, frequently gravel concrete roads or gravel concrete foundations carrying a bituminous surface will be found to be the economical solution.

Contrary to the arguments of many of the advocates of concrete roads, a concrete surfacing is not permanent in the sense that it will last indefinitely without repair. It is unfortunate that in the advocacy of modern road improvement the use of this word "permanent" has been so indiscriminate. No road surface is permanent. All require repairs from time to time if they are to be kept continuously in good condition, and the use of the word "permanent" in the arguments for better roads has been deceptive. Its abuse has produced disappointment, frequently a reaction against the movement, and often extravagance in later expenditures. It is questionable whether or not the cement manufacturers themselves, to whom many of the arguments for concrete roads may be traced, are working for their best interests in the end by their reference to concrete as "a permanent road" surfacing.

MAINTENANCE AND REPAIRS

Concrete roads, in addition to the interest charges to be figured in their long-run cost, require continuous expense for maintenance and repair. Except possibly in those cases where a curb adjoins the edges of the concrete roadway, the shoulders (even if the concrete itself does not) begin to need maintenance the day after the completion of the roadway. The usual sudden transition from the rigid concrete to the softer, shoulder material produces, under the first heavy vehicle that in passing turns out and off the concrete, a de pression or rut along the edge of the concrete. This depression or rut is a vulnerable spot in the armored road and must be immediately protected, by repair, against serious consequences from the entrance of water or from material damage to the edge of the concrete itself. These points of weakness, which also are likely to occur between the earth shoulders and any road surfacing, are, in the case of concrete roads, more frequent and of greater extent, because of the greater difference in rigidity between an earth shoulder and the concrete than between the same kind of shoulder and a gravel road for instance. While the shoulder maintenance may not be a part of the maintenance charges for the concrete itself, it certainly is a part of the road maintenance, especially where, in order to keep the first cost down, the concrete surface has been built too narrow in width to carry on it all the traffic, and a considerable portion of the latter constantly turns out onto the shoulders. Certain road authorities have seemed frequently to neglect, in deciding widths or character of surface to be built, a proper consideration of the comparison between shoulder maintenance costs and interest charges plus surfacing maintenance costs, with the results of dissatisfaction to the road user and excessive costs in the end to the contributors.

The concrete surfacing itself will, after a period dependent of course on local conditions, require repairs, and it is an inherent difficulty of concrete that repairs to it are not easily made. This fact was one of the main reasons for the abandonment of the earlier efforts to use concrete for road surfaces. While these repairs may seem in some respects relatively slight, the expense for them will be inversely large.

Reliable figures of cost for maintenance of concrete roads are not as yet at hand, but the foregoing may serve to indicate, from the point of view of cost, the factors to be considered in this connection and the points of weakness in some of the arguments that have been advanced for the more general adoption of concrete road surfaces.

EASE AND INFREQUENCY OF REPAIR

Reference has been made to the fact that concrete is not easy to repair. The frequency of repair may depend largely on local conditions, but it is also affected by certain peculiarities of any concrete. The mixing together of four different materials and the placing of the resulting mass in the roadway give many opportunities for irregularities to occur. A most desirable feature of any road surface is an ability to wear uniformly, and this is frequently, if not generally, more desirable than a less uniform, even if slower, rate of wear. The difficulties in the way of the necessary high degree of uniformity in cement concrete for road surfaces are apparent when it is recognized that few sources of broken stone deliver a uniform product; that there is frequently considerable variation in the ledge or quarry itself; that there often is variation, even between the products of different days, from the crusher and screens, and that segregation of the smaller from the larger sizes generally occurs in loading, shipping and handling this product. The same may be said as regards the sand in many cases. The quantity of water present in the mixture is frequently more or less irregular and segregation and other causes for non-uniformity generally arise during the mixing and placing of the concrete. All these contribute to the presence so generally noted in concrete road surfaces of spots of unequal abilities to resist wear and to the consequently resulting holes so difficult of proper repair, which form one of the main obections to this type of pavement.

It might be said here that, while proper supervision does reduce to some extent the lack of homogeneity in results, certain inherent irregularities can be reduced only by mechanical means while certain others seem inevitable. For instance the natural irregularity in position of the stone in the surface of the placed concrete may be reduced to a considerable extent by rolling so that, just as in good broken-stone macadam the majority of the larger pieces of stone in the surface will lie with a face exposed to subsequent wear instead of an edge, as is found in most cases of insufficiently rolled macadam. Harrowing a layer of broken stone will result in greater uniformity as to size of the pieces of stone in the surface. Hence there seems to be good ground for some of the claims of the advocates of a concrete road surface formed by grouting the broken stone spread and rolled in place such as in the Hassam pavement. Further, the mechanical bond thus secured between the stone particles is worth considering as an additional factor for strength and durability.

Concrete is not easily repaired so as to be satisfactory. In the first place, the difficulty of remedying a slight depression worn into the surface under traffic generally leads to letting such a defect increase to material dimensions before attempting its repair, which is of course objectionable. To repair any depression with any degree of satisfaction it has been found necessary that the depth of the hole be, or be made, sufficient to provide space for placing in it aggregate of the same size as that which forms the adjoining surfaces and flush with them. Also it is necessary that the new concrete be of uniform thickness, not tapering off at the edges. This means that for the proper repair of a hole the old concrete must be more or less cut away—a rather expensive proceeding. Even then if a good bond—a difficult matter frequently—is not secured between the new and the old concrete, the joints in the surface soon become objectionable. When the ordinary concrete road surface begins to need repair, it is practically only a question of a short time when the concrete surfacing will have to be abandoned as such and turned into a concrete foundation because of the difficulties of repairing the concrete so as to leave it satisifactory as a road surface.

If a concrete road is built of gravel, notwithstanding that the average strength of gravel concrete is greater than with broken stone concrete, the lack of mechanical bond obtainable from the rounded stones in the surface renders the latter particularly susceptible to damage by the shod feet of draught animals. The blow of a horse shoe may break the cementing mortar around a stone and the pushing or twisting of the foot may then easily dislodge the stone from its place. Of course, the adjoining stones are then more easily dislodged and the hole in the surface grows rapidly and needs repair.

The difficulties of proper repair are so well recognized that many engineers are now recommending such work to be done with bituminous concrete instead of cement concrete, but of course this is only a step toward the ultimate transformation of the concrete road (surface) into a concrete foundation.

Again, it seems pretty generally agreed that concrete roads are liable to objectionable cracking under the influence of changes in temperature and in the conditions regarding moisture present. After being placed, the wet concrete shrinks considerably in setting and drying, and this change of volume produces cracks in the surface. These cracks form points of weakness and foci of deterioration more or less serious, according to their distribution and concentration. The effort is usually made to concentrate them in regularly occurring joints, and these joints are predeterminedly built in place with cumbersome iron or steel plates which themselves are objectionable to traffic. These expansion joints increase in obnoxiousness as the road gets older and wears down, and ultimately, in order to relieve this feature, if for no other reason, the coating of the whole road with a bituminous or other surface or pavement is necessary. If these expansion joints are not provided in the first place, the concrete road surface develops cracks irregularly under alternate wetness and dryness or heat and cold, and these cracks break away on their edges and ultimately develop into objectionable places in the surface. Apparently the only remedy then is to cover the entire surface with a carpet or pavement. The concrete road then becomes a concrete foundation, and if it can be foreseen that such an end is probably to result within a limited time the writer believes that reasons of economy demand its careful consideration before reaching a decision to attempt the concrete road construction in the first place.

Ease of Maintenance.—Special machinery is not required for maintaining concrete roads, and in this respect they may have an advantage over such pavements as bituminous concrete and sheet asphalt. Heaters, mixers and unusual tools are not required, nor even steam rollers for at least any but the largest jobs.

Cleanliness.—Concrete pavements are fairly easily kept reasonably clean. They are perhaps less susceptible of dustlessness and thorough cleanliness than is an asphalt surface or the best brick pavement; but, on the other hand, they are more so than macadam or even the ordinary good stone block pavement.

Resistance to Traction.—This is extraordinarily low in the cases of concrete pavements, and few pavements go ahead of them on this point.

Slipperiness.—Concrete pavements are generally more slippery than macadam and stone-block pavements (except in those cases of the latter where the joints are filled with cement mortar) but less so than wood, asphalt, bituminous pavements generally and well laid brick pavements.

Sanitariness.—Concrete pavements are slightly less equal in this respect to the best laid brick, and are sanitary than bituminous surfaces and pavements; are more sanitary than stone block pavements or macadam.

Acceptability—i.e., the bases of personal or local preferences and of aesthetic consideration and of noiselessness. As before referred to, the writer is aware that at present there exists in many minds a prejudice more or less strong toward the selection of concrete for the road surface, regardless of facts. That the propriety of this state of affairs may sometimes be successfully questioned he has attempted to show. As to aesthetic considerations it may be noted that the glaring effect of the mortar in the concrete is frequently objectionable, even when dark-colored stone are used for the aggregate. On the other hand, a light color of the concrete may be beneficial for unlighted roads through woods, especially where there is much travel at night. As to noiselessness, concrete pavements offer slight objections on this account. They are productive of more noise than bituminous surfaces and pavements or macadam but of less than brick or stone blocks.

Favorableness to Travel.—Concrete pavements are somewhat less favorable to travel than macadam or bituminous surfaces and pavements and more favorable than stone blocks or bricks in that their surface rigidity lies between the two types mentioned. An extremely rigid inelastic surface is objectionable to passengers over it even when the vehicular devices for lessening the inevitable shocks are of the highest efficiency. Animals naturally prefer the softer materials on which to tread, especially when unaccustomed to metalled or paved roads. As the proportion of surfaced to unsurfaced roads increases, the latter objection to concrete is somewhat reduced. Complaints have reached the writer from motorists using newly-completed stretches of concrete roads that an unpleasant vibration was noticeable to the passengers in going over such roads, and it seems probable from the description and the writer's own experiences that such vibration was due to minor unevennesses in the surface, unnoticeable to the eye or at low speeds. If the speed be high enough, this vibration can be detected on the best concrete roads, though it seems imperceptible on macadam or on good bituminous surfaces and pavements.

Those who lean toward concrete roads (using the term as perhaps it is more loosely and generally now applied) may attempt to meet the objections offered above by the writer to concrete roads under his definition of the term by suggesting, as is frequently done, that the removal of nearly all grounds for objection and a considerable strengthening of the arguments for the more general use of concrete for roadways may be had by **providing a bituminous surface on the concrete.**

Now this point is the rock on which it appears that so many commanders of the good ship Economy and Efficiency have come to grief. If the concrete layer is finally to be treated as a foundation, why go to the extra expense necessary for even fairly successful use of it as a surfacing? Why make it a 1:2:4 mixture if a 1:3:6 has been so often satisfactory? Why pay for floating and otherwise finishing its surface if this can be just as well avoided by finally surfacing with a bituminous material? Why bother with and pay for unnecessary expansion joints? Foundations seldom have required them.

The reasons for separating the consideration, according to the definition proposed at the beginning by the writer, he hopes may now be apparent. After all, when a concrete layer is to be covered by a bituminous carpet or by a block pavement, are not the considerations regarding the concrete those old ones of sufficient thickness and strength to enable it to perform its purposes, of its composition with gravel or broken stone as may be desirable for economy in first cost, and generally for a road surface? And then, as regards the surfacing layer, are they not the same old ones of character, of thickness, of composition, all to fit best the local conditions?

There certainly is room in the practice of highway engineering for the better and more scientific selection of road crusts. Many are doubtless familiar with instances of good pavements that have satisfactorily survived many years on a cheap gravel or sand foundation with only reasonable charges for maintenance and as familiar with other cases where economy would evidently have been had from the installation of a concrete foundation in the first place. It really seems to the writer that the far larger part of the consideration concerning concrete roads (using the term in its broadest, and perhaps at present more general, sense) is composed of two main parts; first, as to the advisability of providing a concrete foundation for the surfacing; and, second, the determination of the character, composition and thickness of the latter.

If highway engineers will but regard the facts in the matter calmly and conservatively, the writer feels that time and money will be saved and that their reputation as engineers will be enhanced.

Salt Water Said to Preserve Wood Piles

IN replacing a railroad trestle recently burned along the north shore of Great Salt Lake, engineers have just found that the piles are still perfectly sound after 43 years of service. Looking for the cause, since these were only of local pine and fir, they found the timbers impregnated throughout with salt from the lake. At another point on the lake, 18-inch piles, set 29 years, are similarly preserved with salt, which has penetrated to their very centre. Timbers in the Southern Pacific trestles across Salt Lake, placed in 1902, appeared to be as good as on the day when the piles were driven. They have been preserved well above the water line by the salt dashed onto them by the waves, a fact apparently anticipated by the engineers who built the trestles. It is pointed out that the reason why the waters of Salt Lake act as a strong preservative, as distinguished from ocean waters, is because the lake water is so much more salty—being practically a saturate solution. Preservation with salt is of no use in ocean piling against the attacks of teredoes and other marine borers. Experts in the forest service who have been investigating the preservative treatment of timber offer the suggestion that ties and poles which have been immersed for some time in the waters of the lake ought to be impervious to decay if the salt is not leached out by the action of the elements. It has been suggested that this can be guarded against, for example, by painting the butt of the pole with a coat of creosote which will keep out the moisture and keep in the salt.

A Feat in Bridge Construction

A notable engineering feat has been performed at Sibley, Mo., by the Atchison, Topeka, and Santa Fe Railway, which has built a new bridge over the Missouri on the piers of an old one, and has worked the trains over the old and the new bridge without the delay of a single minute to traffic. The old Sibley bridge, built in 1884, was then thought capable of carrying the heaviest trains that could ever be used, but in twenty-five years its capacity was outgrown, and in thirty years some of the trains and locomotives became too heavy to pass over it with safety. The old bridge consisted of one 80 ft. deck girder, one deck truss 197.5 ft. long, three through trusses each 396 ft. long, one deck truss 247.5 ft. long, two deck trusses 172.5 ft. long, twenty-one viaduct spans each 60 ft. long, one deck girder 75 ft. long, one deck girder 20 ft. long, and twenty-one viaduct spans each 30 ft. long, making a total length of 4,043 ft. Its weight was 3,566 tons, or 7,132,000 lb. The length of the spans and trusses of the new bridge is practically the same except at the south end, where a new pier was built between the first and second piers, and two girders of 100 ft. each put in. The steel viaduct approach is 2,000 ft. long, the total length of the new bridge is 4,060 ft., and the weight is 9,953 tons, nearly three times as great as that of the old structure. All the piers were enlarged to support the increased weight of the structure by encasing them in wooden forms which were then filled with concrete, steel reinforcing being employed to bind the concrete to the old piers.

Before a job is settled it is important that executive organization for the work should be well considered. A change in superintendents while the job is under way makes for unsatisfactory conditions, higher labor cost and inefficiency in general.

Concrete reflectors are to be used in the lock chambers of the Pedro Miguel Lock of the Panama Canal in preference to enamelled steel reflectors, the choice being determined by the lower price of the former, by the more suitable light distribution effected, and by the restricted headroom which prevents the use of projecting fittings. The reflecting surfaces are of white enamelled concrete, and for overhead use four-sided reflectors are adopted, while in walls a single plane inclined surface is employed. In side wall illumination the concrete reflector is grouted into a wall recess, leaving a front shade with a semi-circular opening at the bottom, which permits outward reflection of light, while preventing glare due to direct vision of the lamps.

To lessen the delay incurred in drying during the painting and repainting of rolling stock, which adds to the working expenses through vehicles standing idle, the Pennsylvania Railway have adopted what is called a paint oven. This is a double-skinned steel structure of the shape, but somewhat larger, of the largest vehicle on the line, and with one end opening. Into this the freshly painted car is run, the space between the two skins being heated by steam up to a temperature of 250 deg. Fah. There are upwards of 2,000 square feet of heating surface, and it is stated that not only is there much time saved, but the paint so treated exhibits an improved finish. It is obvious that modifications of such a system might be applied to many painted surfaces other than those of rolling stock.

In a recent address to the Manchester section of the Institution of Electrical Engineers, Professor E. W. Marchant reviewed the fields of employment open to the electrical engineer and the financial prospects which they afford. In his opinion electrical engineers are, as a rule, sadly underpaid, and as a result the industry is failing to attract the best men. One cause of this condition of affairs is to be found in the very large supply of capable and skilled men carried by every works of any size, and the comparative difficulty of an engineer, whether electrical or mechanical, in climbing out of his field into another which offers better prospects. Setting up for himself means consulting, agency work, or starting a works. Consulting is attractive in itself, but for well-known reasons offers scope in a limited number of cases only; agency work is obviously limited, but not without some plums; whilst the setting up of a works is impossible to most for lack of capital. Thus there is a tremendous competition of fairly capable men for all posts above a mechanic's wage, and employers, who usually look at the price of a man rather than his value, buy in the cheapest market.

Self-Purification and Care of Water Stored for Public Supply Purposes

THE advantages of the reservoir storage of water are many and the disadvantages are few. Formerly the expression "stagnant water" carried with it many ill-defined fears. It is now well known that still water rather than running water purifies itself the better. The greater the velocity of a stream the sooner is its pollution delivered to the consumer. Much more depends, therefore, upon the time of flow than upon the distance traversed between the point at which withdrawal of water is made. The following discussion of the self-purification of stored waters and the care of such waters when intended for public use is abstracted by Engineering and Contracting from an address by Dr. Wm. P. Mason, professor of chemistry at the Rensselaer Polytechnic Institute, before the Franklin Institute. Under the heading of the care of stored waters the use of copper sulphate for the removal of algal growths is discussed and data on the amount of the material needed and the amount which can be safely used are given. The portion of Dr. Mason's paper which relates to the patrol of water-sheds is omitted from this abstract.

Stagnation has its disadvantages, of course. Increase in color naturally follows if water be permitted long to remain in contact with a muddy bottom loaded with soluble extractive matters. Not only is damage to the water's physical appearance a result of such contact, but the material passing into solution is likely to furnish abundant food for those minute forms of life which carry objectionable tastes and smells to many public waters.

One condition of "standing water," namely, that of being overstocked with vegetable growths, is practically the only one toward which objection can point when considering the pros and cons of reservoir storage.

The word "vegetable" is here to be taken in its broad sense, as it should include not only those growths which would be recognized by the public at large, but also those of the minute world as well, which latter constitute one branch of that lake life known as "plankton."

As an instance of excessive overgrowth, a small lake could be named which is so loaded with dense vegetation that decay gets ahead of new growth, and the use of its water is productive of temporary diarrhoea. It is a stained water, but its color is not to be considered as a measure of its objectionable qualities for table use, as many waters of much darker tint are of excellent quality for such purposes. Color and fitness for drinking bear no relation to each other.

It is true that colorless waters are now demanded by the people, and "meadow teas" are growing in disfavor, but that change in public opinion is of recent date and is not based upon established hygienic ground.

The deepening in color of the lower layers of a water stored upon an unclean bottom; the encouragement of growths of small organisms producing taste and smell by reason of an accumulation of extracted food suitable for their development; and a deficiency is dissolved oxygen in the bottom levels, constitute the sum of objections that can be raised to the impounding of water, and they are much more than balanced by the advantages that accrue from such storage.

The pollution from shore drainage that reaches a reservoir water is likely to be naturally much smaller in quantity than that received by a flowing stream; nevertheless, very serious pollution may occur in concentrated form, even when the efforts of the caretaker are the most earnest. Thus, the writer has seen numerous loads of stable manure spread upon the very steep banks of a small, cup-shaped distributing reservoir. The intention in this case was good, and much pride was taken in the fine lawns of the waterworks park, but a better choice of fertilizer could have been made for such a location. It is entirely possible to protect a reservoir, and to a great degree the water-shed also, if careful policing of the district be established.

When meadow lands are flooded, the extraction of food for plankton growth must of necessity take place, and we are forced to choose between stripping the proposed bottom or else depending upon the employment of some means of killing or removing the organisms that are likely to develop.

As to what could be done to rid a water of the odors due to algal and other growths, the outlook was not very hopeful previous to the appearance of the "copper sulphate process" proposed by Moore and Kellerman in 1904.

The method of applying this chemical is simple enough, and its use is very efficacious. Bought in bulk, it can be had at about 5 cts. per pound, and its distribution is readily secured by filling it into perforated buckets, or even bags, and towing the same by rowboat or launch over the reservoir surface.

Decided objection was raised against such a process of "disinfecting" a public water supply, and the opposition was especially marked in England, but the use of it is still with us and is likely to stay, for the reason that the "dose" is minute and is only occasionally required, that it is reliable in results, and that experiment has shown that it is not followed by the evil consequences predicted.

It must be remembered that it is not added to the water continually but is used only at stated and widely separated intervals, namely, at those times when the "crop" of minute organisms has become so well grown as to produce objectionable effect upon the water.

Perhaps one reason why the "coppering" of reservoirs has led to so much criticism is because of the dead fish that are to be seen after the chemical has been applied. When considering this effect upon fish life, one should bear in mind that the "dose" has of necessity to be applied uniformly over the surface of the water, and each acre of such surface presumably receives the same amount, irrespective of the depth of water that the acre covers. As a result, the shallow parts of the lake receive temporarily a greater quantity of the sulphate, per cubic foot of water, than do those which are deeper; again, the entire quantity of chemical intended for the whole body of the lake is delivered to a few inches of its surface layer; therefore, until diffusion has taken place, fish which chance to swim into such water receive a very concentrated dose and are likely to be affected by it. Distribution is complete by the time the water reaches the public mains, and, moreover, the minute dose used has been more or less [illegible] pletely disposed of through its action upon the organisms for whose destruction it has been employed.

In a paper before the Section of Hygiene of the Eighth International Congress of Applied Chemistry, 1912, Kellerman presented the data given in Table I. on the required amount of copper sulphates.

TABLE I.—QUANTITY OF COPPER SULPHATE REQUIRED TO KILL VARIOUS FORMS OF ODOR-PRODUCING ORGANISMS.

Copper Sulphate Required, Expressed as Parts per Million Parts of Water.

Anabaena	.09
Asterionella	.1
Beggiatoa	5.
Chara	.2 to 5.
Cladophora	1.
Cladothrix	.2
Clathrocystis	.1
Coelosphaerium	.3
Conferva	.4 to 2.
Euglena	1.
Fragilaria	.25
Hydrodictyon	.1
Kirchneriella	5. to 10.
Leptomitus	.4
Microspora	.4
Navicula	.07
Oscillatoria	1. to .4
Peridinium	2.
Scenedesmus	5. to 10.
Spirogyra	.05 to .3
Ulothrix	.2
Uroglena	.05
Volvox	.25
Zygnema	.7

He adds a list of twelve genera of algae that in his experience are causing trouble in reservoirs and ponds:

Number of Observed Cases.

Anabaena	27	Conferva	56
Asterionella	9	Crenothrix	13
Beggiatoa	20	Fragilaria	19
Chara	26	Oscillatoria	49
Cladophora	17	Navicula	21
Clathrocystis	23	Spirogyra	43

Jackson claims that blue-green algae will die if the water be "coppered" one part to five million. His dose for Mellosira or Synedra is one to two million, and he claims that the former gives no odor of growth, but only that of decay. He finds that coppering runs out certain forms of organisms and substitutes others by a sort of selective action, but those thus substituted are not likely to be odor-producers; and he further notes that, while "bottom" or decomposition odors are easily shaken out by aeration, "top" odors, viz., those of growth, have to be removed by filtering out the organism, or killing them by copper sulphate, or both. In his opinion, filtration of either type is effective for removal of odors of growth, but he believes that aeration would be worse than useless for living plankton, for the reason that the agitation would tend mechanically to release the oil causing the taste, which oil is not very easily oxidized.

Naturally the cost of treatment with sulphate of copper will depend in part upon the amount of the chemical that is to be used, which in turn is determined by the kind of organism that it is intended to kill; but it may be said that a mixed growth of Mellosira and Asterionella was removed from the Troy reservoir at an expenditure of 14.9 cts. per 1,000,000 parts of water treated, labor included. The dose was one part of copper sulphate to 3,500,000 parts of water by weight.

In the article by Kellerman above quoted there are figures given indicating the safe limit for treating water with copper sulphate when certain fish are to be protected.

Copper Sulphate, Expressed as Parts per Million Parts of Water.

Black bass	2.1	Perch	.75
Carp	.3	Pickerel	.4
		Suckers	.3
Catfish	.4	Sunfish	1.2
Goldfish	.5	Trout	.14

It must be noted that these figures assume a thorough mixing of the sulphate solution with the whole body of water. They would not hold for the unequal distribution and resulting local concentrations already mentioned.

In some reservoirs which have been formed by the extensive flooding of swamp bottoms there may develop objectionable growths of crenothrix, a general term denoting an aquatic plant which at times gives much trouble because of its tendency to develop in the street mains and clog the pipes. It is often discovered quite unexpectedly, being dislodged by the current attending hydrant flushing or by the draft caused by fire engines. Dead ends are spots likely to harbor it, and its long rusty filaments have been mistaken for horse manure.

There are three types of the growth, each possessing the peculiarity of precipitating from the water in which it grows its own particular metallic hydroxide. By far the commonest of the three is Crenothrix Kuhniana, which demands iron for its development and which deposits large amounts of iron hydroxide as the result of its growth. The iron required for growth must be in solution, and the quantity demanded would seem to be about 0.3 part of iron per million.

In order that the iron may be in solution, we naturally would expect the dissolved oxygen to be low and the quantity of reducing agents, such as organic materials, to be high, and those are the conditions that we find in practice to be favorable to the development of the plant.

It is likely to be encountered in waters from swampy, peaty sources where dissolved oxygen is scanty and where the necessary iron in solution may be had. Driven wells in such localities frequently furnish it. Darkness favors its growth, and its development in city water-mains is often excessive, resulting in a material reduction of the carrying capacity of the pipes. The writer has some doubt about the "manganese" variety of Crenothrix being as rare as some think it is, he having found large quantities of manganese in a heavy Wisconsin growth. Beythien and others have, moreover, noted that the presence of manganese in water directly favors the growth of the ordinary form of Crenothrix.

Beyond the mechanical stopping of street-pipes, Crenothrix is exceedingly objectionable to the laundry interests of the community, for the reason that its rusty filaments cause "iron stains" to appear upon white linen.

Removal of the iron by oxidation and filtration is the best guard against troubles due to Crenothrix.

It must not be sweepingly assumed that all the "plankton" life is to be rated as uniformly objectionable; quite the contrary, as a reasonable degree of it acts as a distinct help in maintaining the safety of natural waters. Thus we find "bacteria eaters," such as many kinds of ciliated infusora, rotifiers, dophnia and the like, feeding upon minute germ life, and doing so to our great advantage.

Reservoir Stripping

With a view to avoid the troubles arising from the undue growth of odor producing organisms the stripping of the bottom and sides of reservoirs below the water line and the removal of a portion of the upper soil has been advocated and carried into practice. This, of course, entails very great expense when the surface to be stripped is at all extensive. At Columbus, Ohio, such work cost $159 per acre. In view of the expense of such treatment for larger reservoirs the question, "Does it pay?" is pertinent.

For the sake of general appearances, if for no other reason, trees, shrubs and bushes should be removed. Dead, standing timber and fallen logs are most unsightly and are very likely to produce complaint from the visiting public. In other words, the reservoir site should be cleared and grubbed, with, of course, entire removal of every vestige of human habitation; but beyond that it scarcely pays to go. The portion of the flooded land lying between high-water and low-water marks should receive especial attention, for the reason that during the periods of its exposure it is capable, if uncared for, of presenting an unpleasant appearance and provoking adverse criticism; with the further objection that heavy weed growth may develop if it be long uncovered, which growth will contribute toward the production of taste and smell when the water again covers it.

In an instance where it was proposed to restore a dam that had been out of repair for over fifty years, the writer advocated the cutting off of the standing dead timber at the existing water level before closing the breach, in order to insure a better looking sheet of water when the reservoir filled. This was for appearances only, as all extractive matter had been leached out of the old vegetation long before.

Aeration, filtration, and the judicious, occasional use of copper sulphate constitute the process at our disposal for combating the annoyance arising from algal growths, and their use will give greater satisfaction than the expensive stripping of reservoir bottoms, a treatment which was so frequently advocated in the past.

Purification in Storage

Dr. A. C. Houston, of the London Metropolitan Water Board, has undertaken some very extended researches upon the question of water purification as a result of storage. He found that in stored Thames water the death of typhoid bacteria took place rapidly, although the rate varied with the temperature of the water. In cold water they lived longer than in warm. and 50 deg. F. seemed to be a critical point above which their mortality rate was much increased.

In his 7th Research Report, Houston states that typhoid bacilli lived in stored raw Thames water for the following lengths of time: At 32 deg. F., five weeks; at 41 deg. F., four weeks; at 50 deg. F., three weeks; at 64 deg. F., two weeks.

Even these figures do not tell the entire story. Put in more detail they read:

	At start	One wk.	Two wks.	Three wks.	Four wks.	Five wks.
32° F.	103,328	[illegible]	180	65	[illegible]	—
41° F.	103,328	14,894	76	6	[illegible]	—
50° F.	103,328	69	11	[illegible]		
64° F.	103,328	39	3	—	—	

He concludes: "It is difficult to escape the belief that thirty days' storage of river water is tantamount to sterilization, so far as the microbes associated with water-borne epidemic disease are concerned."

Dr. Houston adds: "I am well satisfied that a well-stored, rapidly filtered water is likely to be safer than an unstored, slowly filtered water."

Although Dr. Houston is doubtless sound in his judgment that a great measure of safety will result from four weeks' reservoir storage of a polluted water, yet we must be assured that the period of storage is real and not simply apparent; or, in other words, we must know that all of the water really does remain in the reservoir for the specified length of time before it is used for public consumption.

Where the inlet and outlet of a reservoir are near together, as is not uncommonly the case, it makes but little difference what the capacity of the total storage may be; the water simply slips in and out again with practically as little stay as though the reservoir was a standpipe.

If the lake be long, narrow and deep, and all of its water be obliged to traverse its entire length before being taken for supply, then the conditions would appear ideal for purification of the inflowing water before the outlet was reached, and yet even under those excellent conditions it is possible to have introduced unexpected and upsetting factors, unless the watershed is regularly patrolled and inspected.

Disintegration of concrete and corrosion of reinforcing metal was the subject of a report of the Masonry Committee of the American Railway Engineering Association presented at the recent annual meeting. Four conclusions, detailed in the report, are as follows: (1) That concrete exposed to the action of sea or alkali waters or gases containing sulphur, or in which reinforcing metal is embedded, should be dense and rich in Portland cement and should be allowed to harden under favorable conditions; (2) that concrete in contact with alkali waters should be made with aggregates inert to the alkalies in the water; (3) that cinders should not be used for concrete in which reinforcing metal is embedded, and (4) that reinforcing metal should not be painted, but should be thoroughly covered and protected with concrete when in place.

An interesting installation of a plant for the filtration and purification of the water used for the miners' shower baths has recently been carried out at the Mariemont-Bascoup collieries in Belgium. The water contains carbonate of lime, as well as other lime salts, magnesia salts, carbonate of soda, and certain impurities in suspension, to remove which it is subjected to the action of a solution of lime water and one of sulphate of iron. The plant comprises three main components, one which automatically proportions the quantity of lime water to the impure water to be treated, the second for the preparation of the lime water, and the third in which the softening and filtration is effected. The water as it is filtered is also aerated, provision being made in the filtering chamber for a strong current of air to be drawn in with the water. The plant has been in use for over six months, during which time it has, it is stated, given every satisfaction. About 1,540 gallons of water per hour can be treated, the cost working out at approximately 8 cents per 220 gallons of filtered water.

Separate and Combined Sewers in their Relation to Sewage Disposal

By John H. Gregory, Consulting Engineer, New York City

IN the construction of a new sewerage system, or of new sewers, one of the problems which first arises is the question shall the sewers be built on the combined system, or partly on both. Two factors of the greatest importance are the questions of cost and of sewage disposal.

As a general proposition, where both sewage and storm water are to be removed it is probably safe to say that the cost of building a combined system is less than that of constructing a separate system, in which the sewage flows in one set, called sanitary sewers, and the storm water in another set, called storm water drains. This is especially true where the territory is more or less closely built up and the streets are paved. Built in territory, not closely built up nor likely to be in the near future, and where the storm water is easily diverted into natural water courses, the separate system will in general cost less, for the sanitary sewers may be built first, the storm water drains being deferred, or only such drains built as are immediately required.

Combined Sewers

The character of the topography should not be overlooked. With steep grades and relatively high velocities in the sewers it might prove more advisable, on account of the relatively small additional cost, to build combined rather than separate sewers. In narrow streets and in congested districts combined sewers have an advantage by reducing the sub-surface obstructions. With the separate system two pipes are required, and sometimes three, when a sanitary sewer is laid on each side of a storm water drain, built so close to the surface of the street as to prevent the carrying of house connections over it.

With the combined system, but one house connection is needed, whereas with the separate system, especially in closely built up districts with paved yards and areas, two are required, one for the removal of the sewage and the other for storm water from roofs, paved areas, etc. The practice of discharging storm water across the sidewalks to the gutters is not one to be recommended. The storm water is, however, sometimes removed by pipes laid just below the surface of the sidewalk and discharging at the gutter. Such pipes frequently give trouble, and often would not be low enough to drain paved areas adjacent to or in the rear of buildings.

Combined sewers are generally laid on flatter grades than separate sewers and may increase the area which can be served without pumping. They may even eliminate pumping entirely. It sometimes happens that combined sewers can be advantageously adopted for a part of the system and separate sewers for the remainder. The writer has in mind one of the large cities in the east where no pumping is required and in which three-quarters of the city is sewered on the separate system and one-quarter on the combined system because it was too low to be sewered on the separate system without pumping.

Higher velocities are required in combined sewers in order to prevent the deposition of grit. When deposits occur in combined sewers organic matter is likely to be held back and settle out or become stranded and may cause the sewage to be bonded and become stale, or possibly septic, a condition to be avoided, independent of whether the sewage is to be treated or not.

So far the subject has been considered without reference to the question of sewage disposal, one of the most important factors. If the sewage is to be discharged into a body of water without treatment, combined sewers would frequently offer the simplest and cheapest solution of the problem. If, however, the sewage is to be treated, separate sewers have certain advantages. It will be assumed here that the sewage must receive some treatment and that ample opportunity is afforded for the discharge of storm water without carrying any great distance.

Sewage treatment works cost money. It is therefore desirable to keep them as small as possible. Rarely, if ever, would all of the storm water have to be treated; hence the question of treating other than the first wash of the streets, in addition to the sewage, will not be considered.

With a separate system the volume to be handled at the treatment works is made up of house sewage, ground-water leakage and trade wastes. The flow may be increased in times of storm by taking in the first wash of the streets from the storm water drains should it be found necessary or desirable to treat the first wash.

With a combined system, under dry weather conditions, the volume to be handled ordinarily is also made up of house sewage, ground-water leakage and trade wastes. In times of storm, however, the flow in the combined sewers is increased by the storm water from the streets, which changes the character of the liquid flowing. The first wash from the streets is often exceedingly foul and may give a stronger sewage. As more storm water enters the organic content of the liquid is decreased, resulting in a weak or dilute sewage.

If only the dry weather flow is to be intercepted, then the volume to be handled at the treatment works would, in general, be substantially the same from the combined system as from the separate system. With the separate system no raw sewage escapes to the streams, while with the combined system a mixture of sewage and storm water must reach the streams.

It probably often would be the case, that as far as the temporary reduction of dissolved oxygen in the stream is concerned no harm would be done, but floating particles of paper and fecal matter are offensive to the sight. If the stream is sluggish it may easily be that the continued overflow of sewage into it, from time to time, with the accumulation of sludge deposits on the bottom, would lead to offensive conditions.

While considering the question of the overflow of raw sewage from combined sewers the point of view of the public should not be overlooked. They know that the sewage must be treated and their natural inference is that all of the sewage will be treated. But if the sewers are built on the combined system and the public sees raw sewage, even if dilute, discharged into the streams from time to time will they be satisfied? And will the state authorities be satisfied?

In order to reduce the number of times during the year that raw sewage would overflow, it might be planned to intercept some storm water as well as the dry weather flow. This would increase the size of the sewage treatment works, and their cost.

If it is found desirable or necessary to intercept and treat the first wash from the streets, the separate system is more advantageous than the combined system, as by its adoption no overflow of raw sewage to the streams will take place. The storm water drains receive only storm water and the first wash from the streets can be intercepted in the storm water drains and discharged either into the sanitary sewers, or into the intercepting sewer leading to the treatment works. As the flow in the storm water drains increases, the surplus water overflows to the streams but carries no sewage with it.

Separate System More Flexible

The separate system, under certain conditions, offers greater flexibility in the disposal of trade wastes than does the combined system, unless the first wash of the streets is to be intercepted and treated. Some trade wastes are offensive and if discharged into the sewers in such a condition must be treated. Some are inoffensive and can be discharged directly into the streams without causing any nuisance or trouble.

With the separate system the offensive trade wastes can be discharged into the sanitary sewers and the inoffensive wastes into the storm water drains. The offensive trade wastes only would then be carried to the treatment works. With the combined system all of the trade wastes, the inoffensive as well as the offensive ones, would have to be intercepted and carried to the treatment works, with the result that the treatment works would have to be somewhat larger in size, and hence would cost more.

With a combined system automatic regulators are generally used on the connections between the combined sewers and the intercepting sewer to limit the amount of flow from the combined sewers to the intercepting sewer. With a separate system automatic regulators are not required unless the first wash from the streets is intercepted in the storm water drains. Automatic devices in sewers, as a general proposition, no matter how well designed, are to be avoided wherever possible.

The presence of grit at a sewage disposal works is generally more or less of an annoyance, especially when the sewage has to be pumped and passed through settling tanks. With combined sewers, receiving as they do storm water from the streets, a considerable amount of grit must be expected to reach the disposal works, not only during wet weather but during dry weather also. With separate sewers the amount of grit received at the disposal works is relatively small unless the first wash from the streets is intercepted in the storm water drains and carried to the disposal works.

Sand-Catchers

It has been suggested that a considerable amount of grit could be prevented from reaching the disposal works from combined sewers by inserting a catch basin or sand catcher on each connection between the combined sewers and the intercepting sewer. It is probably true that such would be the case but it is a question whether this would be a good method of removing grit. In the first place these sand catchers would sooner or later fill up and unless cleaned at proper intervals would fail to serve the purpose for which they were built. Again, it is very probable that more or less organic matter would be deposited in them, especially when only the dry weather flow, consisting as it would mainly of sewage, was passing through them.

The inserting of sand catchers between storm water drains and an intercepting sewer would seem to be a more practicable proposition. They would still have to be cleaned to make them effective.

It is a question if the simplest way of handling the grit is not to admit it into the intercepting sewer from the combined sewers or storm water drains, without attempting to intercept any portion of it, and then to transport it with a good velocity in the intercepting sewer direct to the sewage disposal works. In any event enough grit is sure to reach the sewage disposal works to require its removal before the sewage is pumped or passed through settling tanks, and the removal of grit at one point instead of at numerous points has many advantages.

With sewage from a combined system the volume of sludge accumulating in settling tanks is greater than with sewage from the separate system. It may even be nearly twice as much, as has been found to be the case by comparison of the quantities of digested sludge removed from different Imhoff tanks, some of which have been connected with combined systems and others with separate systems. The greater volume of sludge from the combined system may mean that less organic matter has reached the streams than would have been the case if the sewers had been built on the separate system. If, however, the first wash from the storm water drains of a separate system is intercepted and carried to the treatment works then the volume of sludge should be approximately the same as if the sewage came from a combined system.

When Sewage Must Be Pumped

In many instances pumping is required in order to pass sewage through a treatment works. It may even be that the sewage would be delivered at an elevation below that of the stream into which the effluent was to be discharged.

With a combined system the total height to which the sewage would have to be pumped would probably be somewhat less than with a separate system, but the difference would not be great. Some saving in fuel might therefore result from the adoption of the combined system, but the same operating force would be required in either case. So long as pumping is required the actual saving in cost due to pumping the sewage against a less head, due to the adoption of the combined system, would be slight compared with the total cost of pumping, including fixed charges.

In conclusion no hard or fast rules can be given for the adoption of either the combined or the separate system. Each has certain advantages. These, as well as local conditions and cost of construction and operation, must be taken into account. Other things being equal, especially as more attention is being given to the question of sewage disposal, the separate system seems to offer greater advantages. With either system, however, to secure satisfactory results too much stress cannot be laid on the necessity of not only proper design, but satisfactory maintenance and operation.

Possibilities of the Nail-Head as a Decorative Medium

NAIL-HEAD decoration—mainly in geometrical form, as studding, etc., to doors—has been largely used in work of the Early English and Decorated periods, but it is very seldom seen in modern work of any description, says the writer in an interesting article in The Building News. No doubt this is mainly due to lack of sufficient consideration of its qualities as a relief or decorative factor. It is certainly worth while calling attention to its possibilities as an inexpensive medium, ready to hand, for a large amount of simple relief possessed of a decided character and beauty of its own. It has the further recommendation of being readily applied in many positions where more expensive methods of decoration would not be considered. Simple, slightly-cut post-heads, for instance, to garden-gates, entrances, palings, etc., can be given a really large amount of decorative finish by the careful disposition of a little nailwork in a studied scheme of design. Geometrical patterns picked out in small nails, with medium and large sizes introduced in judicious positions as auxiliaries to give a more emphasized and varied relief to certain portions, forms a very attractive method—something after the style indicated by Fig. 1. In oak wood especially the nailhead has a remarkably good appearance. A a medium also for the introduction of ornamental lettering or figures it is certainly difficult to rival for picturesque effect. Utilized in this method, it is preferably worked on the diagonal, with small circular nails between, or small square-headed ones, placed on the square. Slight graduations, by different sizes, towards the thickening of letters or figures forms a still further improvement, as illustrated by the date-panels in Fig. 2. Square oak slips about 2 in. or so by ⅛ in. in thickness can be introduced diagonally, either singly or grouped, and secured by a nail in the centre. With smaller ones between, or indicating corners of a design such as shown by the first example of this figure, it forms another simple but pleasing method of relief with this style of ornament. Square, octagonal, or pointed panels can be formed as well by narrow slips, tacked on, surrounding the letters or figures, as indicated by the combination date-panel, Fig. 3. Monograms are also readily introduced to many other positions besides that shown by the succeeding figure, No. 4. More pronounced and decided designs are produced by the adoption, in various cut shapes, of a larger overslip nailed to the post-heads, etc., as illustrated by Fig. 5. A further simple but very suitable combination in the form of an overslip, with the nail-head, is that provided by a small fret panel. Either used as a bold, simple, and central design shown by Fig. 6, or in finer and more detailed patterns, which might often be adopted for many suitable positions. The small design for a garden-gate and railings, Fig. 7, illustrates more clearly the use of the nail-head and slip in general design of a simple character. Such as might be well applied for the entrance to a small house or cottage. Panels, suitably designed, placed either on the gate or upon broader posts, might have the name or number indicated by the same methods. Another very good position for such applied decoration is the door itself, when not too far back. This might also be introduced, either by names, numbers, or a little suitably-applied pattern-work here and there. These positions, however, form by no means the end of the nail-head's possibilities as a decorative factor. There are plenty of other opportunities for its satisfactory introduction in many positions. For instance, the simple narrow slip and nail-head work, very sparingly used, as shown by the porch design in Fig. 8, illustrates further possibilities in quite a fresh manner. It dispenses entirely with the customary stereotyped panelling and moulding usually employed. It is thus possible to erect something of a very different nature to that which is more often tacked on to a building as a mere excrescence, somewhat in the shape of a porch. The example as indicated has a large amount of Doric feeling introduced by the simplest, yet most inexpensive methods. The slips have much the appearance of triglyphs from a distance, whilst the large nail-heads under take the place of metopes. A further extension of this system is that of strapwork design, applied on the same principle. This is illustrated by the small design, Fig. 9. Another departure is illustrated by Fig. 10, simple cut-out panels being formed, and spiked on the face with good nail-heads showing in set positions. The panels to the pilaster portion of frieze are cut shield-shape, with diagonal lines of nail-heads. The spandrels may be formed either by cut-out frets, as indicated, or solid spandrel-pieces might be cut out and nailed in position as raised panels. This short article merely comprises a few systems. The possibility of considerable extension to this class of work in many other directions should be quite clear. At the same time, it forms a pleasing relief from much-overworked ornament decidedly stereotyped in character. It should be quite apparent that the nail-head can be made a very pleasing medium of ornamentation, both artistic and picturesque, as well as practical.

According to a contemporary, great difficulty is being found in getting satisfactory strength in the immense chains now under construction at the Boston Navy Yard for the lock-gate protection of the Panama Canal. These chains and their hydraulic operating machinery are an innovation in canal lock design and operation. They are designed to be stretched across the locks in front of vessels to arrest the momentum of a ship which, for any reason, gets beyond the control of the electric towing locomotives. The chains are made of 3-in. diameter wrought iron; the links are 17-in. long by 10¾-in. wide. The twenty-four chains necessary have an average length of 427 ft. each, and weigh 85 lb. per foot. Great differences in the strength of different links have been found, mostly in the welds where the breaks in the chains tested generally occur. All links are tested to about 275,000 lb. The breaking loads have run from 312,000 lb. to 560,000 lb. Open links appear to be stronger than stud links, in general, but they elongate much more. The parts of the chain which will run over the sheaves of the hydraulic operating machines have open links, while the parts which will span the locks have stud links.

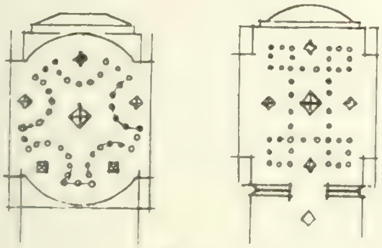


Fig. 1

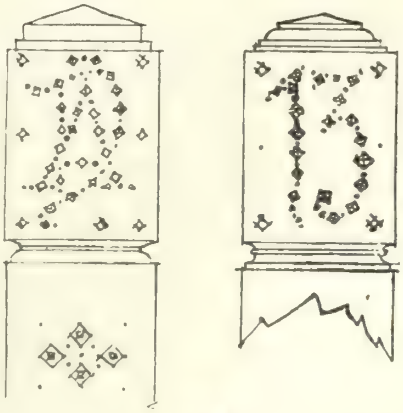


Fig. 2

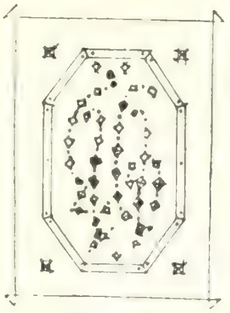


Fig. 3

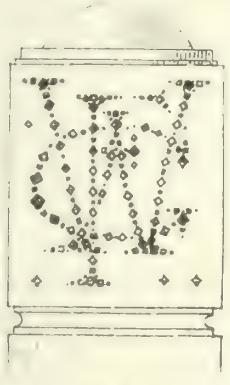


Fig. 4

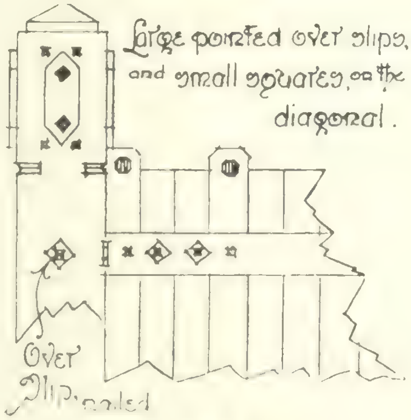

Large pointed over slips, and small squares, on the diagonal.
Over Slip nailed

Fig. 5

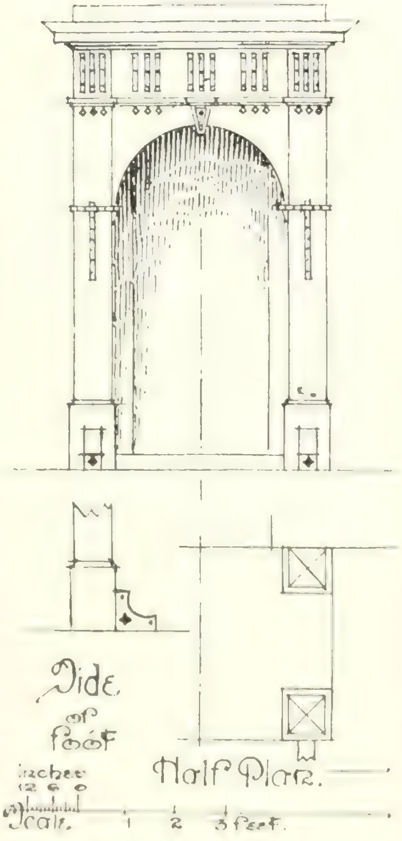


Fig. 8

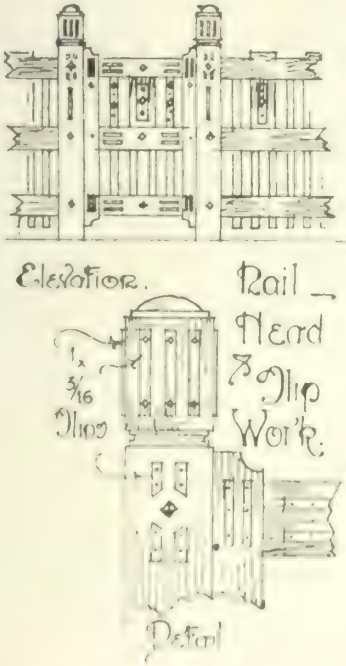


Fig. 7

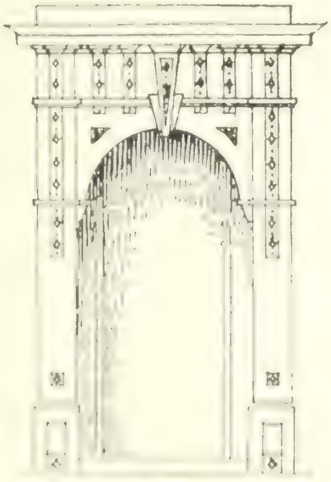


Fig. 9

The Nail-Head
as a
Decorative Medium

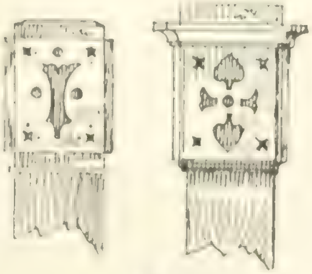


Fig. 6

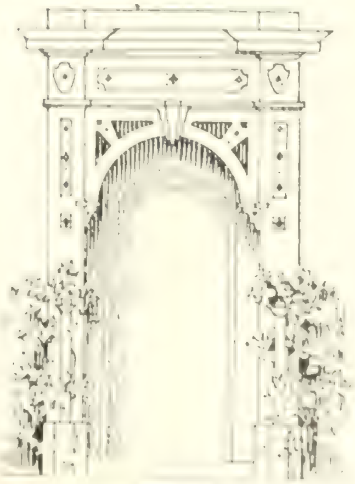


Fig. 10

The Part of the Architect in Structural Engineering[*]

By W. E. Brown, A. R. I. B. A.

STRUCTURAL engineering includes, not only steel work used in buildings, but also all forms of construction, whether in brick, stone, timber or concrete, and in designing buildings and other structures the architect is called upon, not only to exercise his artistic ability, but also so to plan and arrange the various materials to carry safely, in addition to their own weight, all superimposed loads and forces, so that the whole may remain perfectly stable.

The Architect to Determine Positions of all Steel Work

It is the architect, and the architect alone, who should determine the positions of all main girders, stanchions and supports. In many buildings it is impossible to proceed with the design until these positions are determined. In some cases it is the roof which is the determining factor in planning a building—whether the spans shall run from north to south or east to west. In others it would be such a feature as a dome; for example, how could Wren have planned St. Paul's unless he knew beforehand how he was going to support that great and glorious crowning feature of his design? That building could not have been erected had Wren simply made a drawing and handed over the structural work to somebody else to deal with; or had that course been adopted, the resulting design would have been different to that made by the architect.

In a case of rebuilding, which was placed in our hands to carry through, owing to difficulties having arisen after the contract was started, on going through the plans and steelwork drawings I was able to effect considerable economies in the building and also the steel work—in the latter amounting to over ten per cent.—simply by the addition of two stanchions, which eliminated some heavy riveted girders. This was a glaring example of the result of not employing an architect to design the premises in the first instance.

Necessary Information to be given to Engineers When Obtaining Estimates

A good deal of stress has been laid on the question whether the steelwork should be designed, and quantities taken out by a consulting engineer, before being sent out to the constructional firms for estimates, or whether these firms should be allowed to do the calculations themselves. For contracts involving a large amount of steelwork of a complicated nature, I agree that a consulting engineer should be appointed by the architect, but there are many smaller works where this is not necessary, nor would the outlay on the building work warrant the expense incurred. It is quite satisfactory, given certain conditions laid down, to which I shall presently refer, for the architect to send the drawings to several firms of engineers, and let them make their own calculations and quantities; but to enable the various contractors to estimate on the same basis, the following information must be given to each:

(1) Plans of all floors showing the lines of all main girders and the positions of stanchions and columns; also a section or sections and outline elevations must be given.

(2) The loads that each floor has to carry and whether live or total loads.

(3) Whether price is to include for hoisting and fixing, or only for steelwork delivered to site.

(4) If it is to be delivered unpainted, painted or oiled, and if painted with what materials, and that all scale and rust must first be removed.

(5) Workmanship, whether connections are to be rivetted or bolted, and if the latter whether ordinary bolts will be allowed.

(6) Whether the price is to include 10 per cent. profit for the builders or only 2½ per cent. cash discount. My own practice is to state the latter.

Reinforced Concrete

I should just like to touch upon reinforced concrete. This is an excellent method of construction, but the serious drawback to it is what I may term the "human element." Very careful and constant supervision is necessary, or something may go wrong. It is for this reason that I have not employed this method of construction to any large extent, my experience not being a very happy one, and you may be interested in hearing something about it. After a good deal of consideration I decided to put in a reinforced concrete floor and roof over a garage, some of the spans being over 21 ft. Estimates were invited from two specialist firms, the conditions being that the R.I.B.A. regulations and stresses should be adhered to. As regards price, there was not much difference between the two, and no details of construction were submitted with the estimates. When the matter was discussed with the respective engineers I found that, in one case, fixed ends were calculated for where the floor was let into the wall about 3 in., and also where the rods were anchored to steel joists over window openings. I do not agree with such a theory, and so that estimate was rejected. The other engineer satisfied me on these and other points, and agreed to supply me with details and copies of the calculations if the estimate was accepted. He also referred me to several large contracts which his firm had completed.

The estimate was accepted and the work started, but, although applied for, no details or calculations were submitted. In the meantime one bay was put in, the rods being inserted haphazard from 1 in. to 2½ in. from the bottom of the slab. I took particulars and worked out the stresses, assuming the steel to be 1 in. from the bottom, and found the steel stressed to nearly 25,000 lb. per square inch and the concrete (4:2:1) 1250 lb. per square inch. I immediately wrote stopping the job, and received a visit from their chief engineer, who brought a small slip of paper with some calculations showing 20,000 lb. stress in the steel and 750 lb. in the concrete. I adhered to my figures, which he borrowed for further consideration, the end being that I received a visit from an eminent consulting engineer—a member of this Institute—who accepted my figures and came to ask what was to be done. To cut a long story short, the floor was taken out and new floor put in of a greater depth with additional reinforcement,

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[*] Abstract of a paper read at a recent meeting of the Concrete Institute London, Eng.

The trouble, however, did not end here, as I found the bars over the entrances, which were 32 ft. wide, being put in without any support under the ends. What would have happened had this not been discovered in time, I leave you to guess.

When I tell you that I have seen specialist firms' own men sawing up timber for centering and the sawdust and-shavings and small pieces of wood all left and mixed up with the concrete, I think one's faith in trusting to such people is rudely shaken. One requires a good Clerk of Works, well up in reinforced concrete construction, with several smart assistants under him, to look after the work. For small jobs this would be too expensive, and in my own work I have gone back to small steel joists and concrete. The general contractor is competent to carry out this work, and one does not have the delay and friction between contractor and sub-contractor which so often takes place.

Here let me utter a warning against using breeze for floors. There is a very great danger of expansion, and I know of several cases where this has occurred and pushed walls several inches out of upright, and even when the wall was rebuilt it happened again. There is also a corrosive action between the concrete and steel which in time may endanger the stability of the floor.

With regard to shear in reinforced concrete slabs and beams, I do not consider it wise to calculate for the concrete taking any part of the shear, although the R.I.B.A. regulations, and, I believe, those proposed by the London County Council, give 60 lb. per square inch as the allowable shear stress. My reason for this is that long before the reinforcement can be stressed up to 16,000 lb. per square inch the concrete below the neutral axis must be cracked in all directions. They may be very fine cracks, it is true, but for all that, in my opinion, the concrete has lost all its value to resist shear. The steel alone should therefore be calculated to resist the shear, and this does not involve a large amount of additional steel, as the tension rods can be turned up and used for this purpose, most of them not being required at the bearings to resist tension. For this reason it is advisable to use a number of small rods rather than a few of larger sectional area.

Expanded metal is an excellent form of reinforcement for slabs, and binds the whole of the concrete together. It would be interesting to know if the method of manufacture has any deleterious effect on the tensile strength of the steel, and whether, when the metal is fully stressed, there is any possibility of rupture where the strands bifurcate. I presume, in calculating the area of steel, when using expanded metal, that two strands would be taken for a width of slab equal to the mesh of the reinforcement.

In large beams and pillars there is often a difficulty in getting the reinforcement into the correct positions, and also in having the rods properly surrounded with concrete. I have seen several cases where the main rods project beyond the concrete, and to render the same up afterwards is not effective. Another important item to see to is that all of the rods, where they pass in connecting beams and pillars together, are surrounded with concrete. It is a difficult matter sometimes to do this, and considerable skill is required in arranging the rods in positions such as I have mentioned. As far as possible, I think that the reinforcement for all beams and pillars should be assembled on the ground and the rods securely wired together to keep them in their correct positions before being placed in the forms. There is less likelihood of the rods being displaced than there is if the rods are first laid in the forms and wired up afterwards.

It is also very important that all forms should be properly cleaned out before any concrete is put in, and the best way of doing this is by water and a hose-pipe.

Conclusion

These are only a few of the details that come within the purview of the architect, and I hope you have not been wearied by the reference to what many of you may consider to be minor matters in structural steel work, etc. I have refrained from touching upon calculations, which have been, and can be, more ably and fully dealt with by others whose every-day business is to deal with such matters, and who are consequently more competent to do so than myself. I hope, however, that some useful information on the several questions I have raised may be brought out in discussion. You will agree with me that it is in details that an otherwise good and sound scheme may prove deficient.

Why Brick Houses are Cheaper

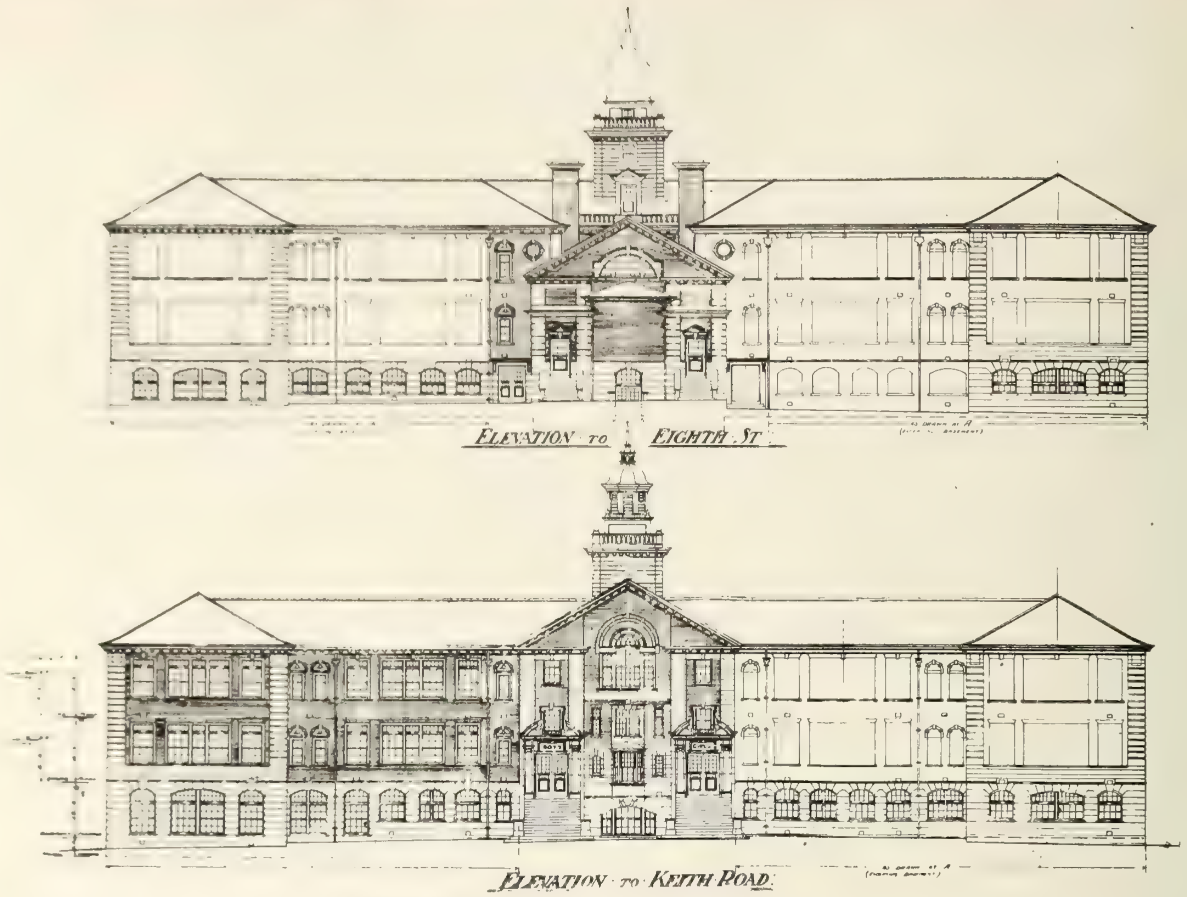
AN Indianapolis architect, who was recently asked by a prospective home builder why so large a number of small houses were being constructed with brick exteriors, instead of frame, as in the past, and questioning the economy of brick construction, made the following statement, reported by Brick and Clay Record:

"There is a belief in the minds of a great many people that brick construction costs from 40 to 50 per cent more than frame construction. Experience and investigation, however, have shown this belief to be a fallacy. The large number of brick residences that have been built during the last year have done much to establish the fact that brick is really the best material for the economical builder to use.

"An investigation of the costs of building materials with the aid of an architect will prove both interesting and instructive, especially when the brick construction is compared to the cost of frame construction. In frame construction, labor is employed in seven different instances, namely: (1) The studding, which forms the frame of the building; (2) the sheathing; (3) the building paper; (4) the weather boarding; (5) the lathing; (6) the plastering, and (7) the painting, which requires three coats to get good results. In brick construction, but two processes are necessary: (1) The brick work, and (2) the plastering.

"Carefully compiled statistics show that the actual cost of brick walls over frame varies from 15 to 40 per cent, depending largely on the price of the face brick selected. As the walls of any building cost only about 10 per cent of the total, brick construction would add only from 2 to 4 per cent to the total first cost of the building. As it is necessary to repaint a frame dwelling every few years, it will readily be seen that brick construction, besides being the best, is the cheapest. A building constructed of brick is much easier heated than a frame one, and the saving in fuel is an item to be considered. Also, it must not be forgotten that with the faces and shades of brick now being manufactured it is possible to build a handsomer building of brick than from any other material."

Sir William Van Horne, [illegible] present on a six weeks' trip to England.



Proposed Central School Building, North Vancouver.

Splendid New School for North Vancouver

TENDERS were taken last month for the proposed Central School building at North Vancouver for which Mr. W. C. F. Gillam, of Vancouver, is the architect. Work on the general contract was expected to be well under way by the middle of June. The building, which will cost $120,000, will occupy a large site bounded by Keith Road, Eighth Street, Mahon Avenue, and Chesterfield Avenue, and will measure 204 x 140 feet. It is to be fireproof, having two storeys and basement with sixteen class rooms and masters and teachers' rooms, manual training and domestic science rooms, sewing room, drill hall and gymnasium and a large auditorium measuring 88 x 35 feet, including a balcony with seating accommodation for about seven hundred people. The main constructional features comprise reinforced concrete frame, brick and tile walls with stone trimmings, interior tile partitions, slate roof, fir block wood floors, ventilating and steam heating system, up-to-date plumbing arrangements, electrical work and an inter-communicating telephone system.

Mr. Gillam, the designer, is a well-known expert in the field of school planning. One of his recent and most important works is the Provincial Normal School at Victoria, costing $400,000, a building which is rapidly approaching completion.

The Strength of Brickwork

IT is only natural that when a brick manufacturer has had the crushing strength of his bricks tested, he should be pleased to show to all likely customers a certificate to indicate the superiority of his bricks in this respect. It is equally right that architects engaged in the design of buildings intended to carry heavy loads, such as factories and some public buildings, should lay considerable stress on the necessity for the bricks showing a certain resistance to crushing. But of what real value are these tests? asks The Brickbuilder.

Most machine-made bricks will have a crushing strength of 2,800 pounds per square inch, and if reasonable care has been taken in their manufacture, a much higher strength is not uncommon. Engineering bricks may easily double this figure, and in some works the average crushing strength of the bricks is no less than 4,000 pounds per square inch.

When the bricks are built up into masonry, however, the structure will not safely stand a load of more than 100 pounds per square inch, and only with the best building bricks is a load of 210 pounds per square inch considered safe. This is due to the fact that the mortar used in laying the bricks is, in itself, far weaker than the bricks, and it only gains strength as it hardens. Yet various investigations of ancient buildings show that lime mortar seldom, if ever hardens completely in the interior of the joints, so that the weakness of brickwork is not due to the bricks, but to the imperfectly hardened mortar.

This drawback can be overcome by using cement and sand in place of lime and sand for the mortar, and, provided that the joints are kept thin, and the correct proportions of cement are used, this cement mortar will not prove more expensive than ordinary mortar. On the other hand, the strength of the brickwork will be increased many times, and a crushing strength of 3,800 pounds per square inch—corresponding to a safe load of 380 pounds per square inch—is not difficult to attain.

The use of cement mortar, therefore, provides the manufacturer of bricks with a means of showing how enormously strong structures may be made at prices to compete with the rivalry of concrete. If the matter is worked out carefully, it will be found that bricks at 27s. per thousand can be reinforced and laid in cement mortar at a cost which is well below that of concrete, provided that the building is one which will really give both materials a fair chance. Moreover, the brick building will have an admittedly better appearance than the concrete structure, and the chances of failure by electrolysis and other adventitious causes are much less. Hitherto most brick manufacturers have been content to accept the statements of other people that concrete is stronger than brickwork

One fact must be observed in the use of cement: It is very liable to form scum or whitewash unless the mortar is properly made, and this would disfigure the building, though even then it would not be worse in appearance than many of the concrete buildings now in existence. This scum may, however, be avoided by mixing some dust made by crushing soft, red bricks with the mortar, as this brick-dust combines with the lime set free from the cement, and not only increases the strength of the mortar, but also prevents any whitewash being formed. This method was known to the ancient Romans and Greeks, and was used by them in many of their most important buildings.

There is much to be done in the way of reinforced brickwork. The pity of it is that many brickmakers are content to see trade going into the hands of the concrete makers, whereas if they only took the pains to enlighten their local builders and architects as to the advantages of reinforced brickwork over concrete in most localities, there would soon be an increased demand for bricks.

In the course of an article in the Engineering Review, Mr. Ewart S. Andrews describes an interesting steel dome in the Wisconsin State Capitol at Madison, Wis. The dome and its supporting tower form a steel structure independent of the remainder of the building. The dome is 90 ft. in diameter at the base, and its summit is 236 ft. above the ground floor, which is taken as the datum level; above the dome rises a lantern to an elevation of 267 ft. Eight reinforced concrete piers are carried by four reinforced concrete footings, and the sixteen steel columns of the structure are embedded in pairs in these piers. These columns extend to a height of 78 ft., and are capped by plate girders forming a ring course, octagonal in plan, with alternate long and short sides. From this point at the top of the tower to the top of the lantern the superstructure was designed as a steel frame building. The weight of the whole dome and substructure is 30,000 tons, and this is carried by the four reinforced concrete foundation piers on footings 16 ft. thick, the pressure on the soil being 3½ tons per square foot. The weight of the steel work is 3,000 tons, of which 900 tons is carried in the substructure.

Moving Loads on Bridges

STRUCTURAL significance of moving loads on highway bridges, was the subject of a paper recently presented before the Western Society of Engineers, by Prof. F. O. Dufour, Assistant Professor of Structural Engineering in the University of Illinois. The paper was based on the carefully recorded results of tests and experiments, extending over several years, on highway bridges under moving loads. The bridges were located in Champaign and La Salle Counties, Illinois, and comprised through-truss spans of different lengths with different widths of roadway, and with flooring of either plank or reinforced concrete. Professor Dufour's conclusions are summarized as follows:

1. That built-up members are superior to single shapes.

2. That light loads produce the greatest percentage of impact, but that the light-load static stress, plus the light-load impact stress, does not exceed the static stress for which bridges are usually designed.

3. That reinforced-concrete-floor structures are much superior to the plank-floor structures.

4. That on account of the fact that the stresses produced by heavy loads in reinforced-concrete-floor structures are very small, the impact percentages were difficult to determine, and that the values given are probably far in excess of the actual, which appeared in the majority of cases to be zero.

5. That actual stresses in reinforced-concrete-floor bridges may be assumed as one-half the computed static loads.

6. That considering conclusions 1 to 5, we may safely neglect impact in reinforced-concrete-floor bridges, and that we may assume each joist to take 20 per cent of the wheel load or 10 per cent of the axle load.

The Modern Architect

THE Engineering Record, in a recent issue, discussing the complex duties of the practice of architecture to-day, states editorially: "Before passing hasty judgment upon the architect of our own times, think a moment of the evil days upon which he has fallen. In the mediaeval times he must perforce know only the technique of masonry—the rest was his art. If he were building a church the fine stimulus of the Gothic was his inspiration and his medium was craftsmanship in stone. To-day he must know masonry and concrete, structural steel and sanitary plumbing, lighting and heating, electric wiring and acoustics.

"His predecessor did not have to plan for buying his stone from one source; his steel from another and his woodwork from a third; he was not hounded by agents of patented devices nor pestered by circulars of supplies offering him 'the usual architect's commission of —— per cent.' All these things the architect of to-day has to endure, besides being called a slavish copyist if he turns to the best in antiquity and a commonplace innovator if he does not.

"His chief hope is in suiting himself as best he may to new conditions, calling in technical advisers on the details which he cannot in the nature of things have time to master, even if he has the ability, standing the more firmly by the interests of his client as he comforts a regiment of sub-contractors, and remembering that he must be artist before being engineer or contractor. Originality and resourcefulness are much more difficult to find than technical or constructional skill, and if the architect is to be more than a master mason or boss concrete mixer it must be by the possession of these attributes. Art did not die with the Gothic nor perish with the Romanesque. The times have changed and the architect must change with them.

The Bulk Handling of Cement*

By H. M. Capron†

THE use of cement in bulk is comparatively new. My experience with bulk cement started with the mechanical problems involved in handling and storing the material and other aggregates at the mixing plant, measuring and conveying them to the mixer, and mixing and handling concrete.

Some of the large cement companies, and a few progressive contractors, have been studying this problem recently. I am indebted for many ideas to Mr. Robert F. Hall, Assistant Sales Agent of the Universal Portland Cement Company, who has made a very careful study of the subject of handling cement in bulk.

Like all new ideas, its beneficiaries accept it reluctantly, and its advocates are subject to the criticism which greets all pioneers. It is remarkable of human nature that the people who are most benefited by a new idea are the slowest to adopt it; and it is equally significant that once a contractor has used bulk cement, he becomes one of its most enthusiastic converts. It requires no little originality, and a great deal of courage, to depart from a custom of years' standing in any line of business, and such departure must, of necessity, be founded upon logic which is absolutely sound.

Ever since Portland cement became a factor in the contracting business it has been delivered to the ultimate consumer in packages. At first wooden barrels were used, but these were so cumbersome and difficult to handle that a small package was substituted, and now cement is handled almost universally in cloth sacks, or paper bags, four of them constituting the commercial unit—the barrel.

Cement is only one of the component parts of concrete. The fine and coarse aggregates—sand and gravel, or stone, have always been handled in bulk, and an inquiring mind uninfluenced by business custom would naturally ask "Why should cement be delivered in packages when the other aggregates are always used in bulk? Careful consideration of the subject showed many reasons why cement packages could, and should, be eliminated from a great many classes of concrete work, and to demonstrate the practicability of this new idea, the people who originated it presented it to certain contractors for their favorable consideration, which was at last secured.

The present age is one essentially of conservation, not of conservatism, and if it can be shown satisfactorily that there is an economic waste in packing cement in sacks only to reduce it to the bulk condition before it can be used, the attention of every contractor who must necessarily pay for this packing and unpacking of cement is immediately challenged. If the contractor can be relieved of this expense and at the same time can purchase his cement for a less figure, it is obvious that there will be a larger margin of profit for him in his work. Those who adopt this method first will have the advantage over their competitors.

The cement company which developed this idea offers cement in bulk for 42 cents a bushel barrel less than the price of cement in cloth sacks. Forty cents of this is, of course, represented by the cloth sacks themselves, and two cents represents the saving to the cement company in packing and loading cement in bulk. Therefore, as far as the manufacturer is concerned, the only saving in this method is in elimination of the cloth sacks which would otherwise be used. This, of course, relieves the manufacturer of the cost of counting, inspecting, cleaning, and repairing these sacks when they are returned to the mill by the contractor for credit. On the other hand, new machinery is necessary to load and weigh bulk cement when it is placed in cars. A device called a weightometer has been adapted for this purpose. This machine consists of a belt upon which the cement is conveyed into the car. This belt passes through the weightometer and all the cement on it is automatically weighed and recorded by the machine, so that the operator can tell by a glance at the dial exactly how many pounds of cement have passed through the machine into the car. A car of bulk cement, therefore, in being loaded, is weighed as a unit. When it is loaded, figuring—as is done in the United States—376 pounds to the barrel of cement, and assuming that the car is to contain 250 barrels, the belt is stopped when the dial registers 94,000 pounds, and the entire car is thus weighed in one operation. If the same car be loaded with cement in cloth sacks, 1,000 sacks would be required, and likewise the necessity of weighing 1,000 separate objects. Thus the liability of error in weighing is reduced from one thousand chances to one. It is, of course, the object of every honest manufacturer of cement to furnish correct weight, and cement in bulk represents the most satisfactory way of doing this.

Protecting Cement From Moisture

Some doubt may be raised as to the difficulty in protecting the cement from moisture, both in transit from the mill and at the mixing plant, but this has proved to be purely theoretical. The damage to bulk cement in transit by reason of a leaky car is shown by actual experiment to be 50 per cent of the damage the same amount of water would inflict if falling on cement in cloth sacks. The reason for this is that when water comes in contact with the cotton cloth, by capillary attraction it spreads to the adjacent sacks, so that a leak in a car roof will frequently ruin a whole tier of sacks from top to bottom of the car, and damage a large part of the cement contained in these sacks. If water falls on bulk cement, it is absorbed immediately where it falls and the resulting damage consists of a crust of cement depending in size on the amount of water. The damage is confined to the spot immediately under the leak, and all the damaged cement can be lifted from the car in this cake.

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*Paper read at the First International Road Congress at Montreal last month.

†President, Marsh-Capron Manufacturing Company, Chicago.

Experience has shown that the handling of bulk cement does not raise as much dust as cement in cloth sacks. The cement sifts through the sacks with the many handlings so that the natural cohesion between the particles is broken and the dust is blown away or falls off. The method of handling it in bulk saves all this waste. The method of handling, of course, varies with the physical conditions surrounding the work.

In the early stages of the development of bulk cement shipment, the material was handled successfully and in large quantities by contractors who did not spend a single cent on special equipment. They reasoned that if they could handle and measure the sand and stone (which is 90 per cent of the concrete job) by means of wheelbarrows, they could handle and measure the 10 per cent. that it would require, with equal accuracy and facility. A great many jobs of considerable magnitude are still being carried on in this way, but naturally the possibilities of bulk cement in saving labor and increasing the output of a concreting plant may be realized more fully by means of equipment more particularly adapted to the work. When the work is adjacent to a railroad track and the size of the job warrants it, a bin may be constructed alongside the track into which the bulk cement is conveyed by means of the bucket elevator. On one side this bin is built a hopper for the coarse aggregate, and on the other side one for the fine aggregate. Both of these aggregates feed from the bottom of their respective hoppers, through spouts, into the mixer hopper. Experience has shown that a non-tilting type of concrete mixer lends itself best to a plant of this kind, as it requires less head room. These aggregates are handled from the cars into these hoppers by a clam shell operated by a standard hoisting engine or by the same bucket elevator used in elevating the cement.

Many Operations Saved

Bulk cement is moved from the car by a scraper similar to that used for unloading grain. With this the cement is scraped from the door of the car into the chute which feeds into the bottom of the elevator leg. From the bin the cement falls by gravity through a measuring box into the mixer hopper. Thus we see that the only labour connected with delivering the cement into the mixer is that required to unload the car with the device above described. Two men, in one hour, can easily unload a car containing 250 barrels of cement in bulk. By this method the contractor is saved the cost of the labor which otherwise would be necessary to perform the following activities:

1. Carry the cement, sack by sack, from the car to the storage shed, and pile in shed.
2. Carry the cement, sack by sack, from the storage shed to the mixer platform.
3. Untie each sack and empty the cement, sack by sack, into the mixer hopper.
4. Shake out the empty sacks over the mixer-hopper to relieve them of all their contents.
5. Lay the sacks aside to be bundled.
6. Bundle the empty sacks for shipment to the mill.
7. Remove the bundles of empty sacks to the storage shed to await the accumulation of a shipment.
8. Load the bundles of empty sacks into a car for shipment to the mill, prepaying the freight on them. Then ensure a long wait while the sacks go to the mill and are counted and inspected there before a credit can be issued on them and a check sent to the contractor for the value of the good sacks found in the shipment.

In every one of these eight stages the sacks are liable to damage by abuse of careless workmen, by exposure to the weather, and in many other ways. Sacks also make convenient aprons for workmen, tool bags, cushions for drivers to sit on, and it is reported that even shirts made of cement sacks are stylish among some workmen. The loss on a job of this kind in all of its many phases is estimated by contractors at from five to ten cents a barrel on the amount of cement used.

Every contractor who handles Portland cement recognizes that the empty cement sack is the most fruitful source of dispute with the manufacturer, of loss on the job, and of general inconvenience in handling cement. Everyone will recognize that the elimination of the sack on the job would be a great boon. If beside securing the advantages incidental to removing the sack entirely from the work, the contractor finds himself relieved of a large item for labor in handling these sacks, both full and empty, there is no question that he should use cement in bulk wherever feasible. Where the mixing plant is removed from the railroad track 100 ft. or more, belt conveyors have been used to take the cement from the car to the elevator connected with the overhead bin. The fine and coarse aggregates may be handled over the same belt into bins provided for them so that the gravity-feed into the mixer hopper can be applied to all of the materials going into the mixer. The number of laborers saved by this kind of an arrangement varies with the magnitude of the job and in any case the saving well repays the contractor for the installation of the necessary handling machinery and for the construction of these overhead bins. But, as it has been said, the physical conditions of each job will require an arrangement best suited for its individual need.

Cement in bulk takes up less room on the job, which is sometimes very desirable. Take, as an illustration, a large paving job which we were called in on last week. This job requires 30,000 barrels of cement, which means 120,000 sacks. At 10 cents a sack it takes $12,000 more to finance the job than if the cement were delivered in bulk. This bag money is tied up until credit is received from the manufacturer for sacks returned, and every contractor knows how long it takes to get this credit.

Figure the average loss of sacks and interest on money invested in this case at 10 cents a barrel, or $3,000 actual loss, to say nothing of extra labor required in handling all these sacks, and in any case the amount of capital necessary to finance the job is materially reduced. It is quite evident that this subject is worthy of study by all contractors on large work.

It is reported that construction will soon be begun of a railway bridge connecting Rugen, an island in the Baltic Sea almost due north of Berlin, with the mainland of Germany. This bridge, when completed, will be one of the longest in the world, exceeding even that over the Hwang ho, which is 10,740 feet long. The structure will probably include a track for pedestrians, although none for road traffic, and when completed it will substantially shorten the journey between Berlin and Hamburg on the one hand, and Stockholm and Christiania on the other. The cost is estimated at about $5,000,000.

The New Vancouver Club Building

THE new Vancouver Club building, illustrated herewith, has been erected in Vancouver at a cost of $290,000. The design of the building is called out in modern Renaissance. Terra cotta and light brown pressed brick have been used as the facing for the street elevation, while the side and rear walls are faced with 12-inch Dennison tile and rendered in cement. The cornice work at the front is in terra cotta. Tar and gravel have been employed for the roofing. The Hennebique design of reinforced concrete has been followed throughout for all reinforced concrete work. There are several panel beams of approximately 56-foot spans over the main dining room and billiard room, and one beam with a 60-foot span supports the two upper floors. The main entrance consists of a large vaulted vestibule which leads into a spacious lobby lounge with domed and ornamental ceilings.

The New Vancouver Club Building.

The building was designed by Messrs. Sharpe & Thompson, Vancouver, who, by the way, are the architects for the proposed British Columbia University buildings. The general contractors were the Norton-Griffiths Steel Construction Company, of Vancouver.

Some of the difficulties which confronted the English engineers when constructing some of the railways in India are referred to by a writer in the Philadelphia Record. Cliffs rising several thousand feet from the river, almost as smooth as brick walls, had to be passed. The services of the best cragsmen in the mountains were secured. The boldest of them, who would creep where a goat would scarcely venture, bored holes at intervals of 15 ft., in which they fixed strong iron bars. On these were hung ropes and planks, from which the men could begin their work, while suspended thousands of feet above the river. When the bold cragsmen came to a part of the cliff so smooth that even they could find no foothold they would scale the precipice by going back and ascending it at some point which afforded footing. Fixing an iron bar in the rock as low down from the top as they could, they would be let down by a rope until they hung at the level of the proposed road. Then, boring the rock, they would fix therein an iron bar and connect it by a rope bridge with the last point gained. The active hillmen, careless of dizzy heights, would crawl on the bridge, bore the cliff, and let in bars at the intermediate points. On these bars planks were laid, on which worked the coolies who built the viaducts.

The fire risk in floor openings to accommodate belt or rope drives has not been as fully appreciated as the safeguarding of vertical openings through floors at stairs and elevators by placing them in towers well cut off from the remainder of the building. The protection of belt openings has been handicapped by the lack of a construction suitable for use in mill buildings where the belt or rope towers were not provided for in the original design. Partitions of expanded metal and cement construction, 2-in. or more in thickness, have been found well adapted for the enclosure of such main drives in existing buildings. These cement partitions, it is said, can be installed at a cost not greatly in excess of combustible forms of construction.

"In making fire prevention work effective the public has to be considered," said Robert D. Kohn, president of the National Fire Protection Association, recently. "Men are continuing to put up buildings badly constructed, dangerous to life and to other property; putting such structures up mainly through ignorance. The difference in cost of fireproof and non-fireproof construction has been gradually cut down. To-day for structures of any importance this difference is so small that the owner would be amply recompensed for the increased cost by the lower insurance rate. In buildings where the cost of fireproof construction is still prohibitive there are simple protection devices which can be introduced to make a non-fireproof building almost as safe as one of steel and concrete."

In a paper read before the American Institute of Electrical Engineers, Mr. L. A. De Blois gives a description of investigations conducted for a large manufacturer of explosives to arrive at a suitable system of lightning protection for buildings containing explosives. The paper is divided into the following sections:—(1) An analysis by oscillograph of the secondary currents induced by actual lightning discharges in vertical earthed conductors, the results seeming to indicate that such currents are non-oscillatory and aperiodic, though occurring in either a negative or positive direction. An attempt is made to explain the phenomena generally attributed to high-waves of almost vertical front. (2) An investigation of the primary effects of a 20-in. spark in air having the same essential characteristics as those attributed to lightning when applied to a model protective system consisting of isolated vertical conductors surrounding a small building. (3) An investigation of the secondary effects produced under the above conditions, which are considered to be static inductive rather than dynamic inductive. A brief description is given of a general protective system recommended for explosives buildings.

Personal Mention

Mr. J. R. Duncan of the Vulcan Ironworks, New Westminster, B.C., is visiting several steel works in the Old Country.

Mr. C. R. Yuill, C.E., has completed plans for the construction of four reinforced concrete bridges for Armstrong, B.C., to which city he is consulting engineer.

Mr. G. R. Blair is acting-manager for Ontario of the Eugene Phillips Electrical Works, Limited, Toronto, pending the appointment of a successor to Mr. T. R. Fulton, resigned.

Mr. A. E. Foulds, of Brantford, is discontinuing his business of manufacturers' sales agent and dealer in building supplies to accept a position as estimator and purchasing agent for Messrs. R. H. Secord & Sons, Limited, general contractors, of Brantford.

Obituary

Mr. Wm. R. Perrin, President of the W. R. Perrin Company, Toronto, manufacturers of filter presses, died at Chicago recently, aged 50. He was the architect of the new municipal abattoir at Toronto, Ont.

Profesor Robert Crawford, the eminent engineer, who carried out several important schemes in Canada, died on June 9 at Ballyshannon, Ireland. At one time he filled the chair of engineering at McGill University.

Mr. Robert H. Skelton who for six years past was manager of the Ontario Sewer Pipe Company, Limited, Mimico, Ont., died suddenly from hemorrhage of the brain on June 10. Deceased was at one time G. T. R. station agent at Mimico.

Mr. Robert H. Jupp, engineer for the county of Simcoe, Ont., was instantly killed on June 5. When inspecting work on a new county bridge being constructed at Nicolston, between Alliston and Cookstown, he fell through a hole in the flooring and dropped a considerable distance to the hard ground. For several years the late Mr. Jupp has held the position of County Engineer of Simcoe, and superintended the expenditure of large sums on the roads of the county.

Mr. Wm. Armstrong, C.E., died at his residence, The Priory, Toronto, on June 9, at the advanced age of 93. The late Mr. Armstrong, who was a native of Dublin, Ireland, came to Toronto in 1851. As a civil engineer he designed and built important sections of the old narrow gauge Grand Trunk Railway. He accompanied Sir Garnet Woolslley, as chief engineer with the first Railway Expedition. He was also a well-known artist and a member of the Royal Academy. He was the son of General Sir Alexander Armstrong, who was at one time Commander-in-Chief of the British Army and who fought at Waterloo.

Miscellanea

The steamer Pueblo of the Canada Cement Company, of Montreal, is reported to have carried away six lock gates on the Welland Canal on June 10. The accident was due to the steamer being driven ahead instead of astern after entering lock 9, with the result that the foot gates were unmitred and pushed out. The rush of water tore both head gates from their fastenings and also damaged the two head gates on lock 8. The head gates of lock 9 are fitted with the Gowan safety device, but the lower gates, with which the boat collided, are not so equipped. Repairs were carried out by a Government crew.

Arbitration proceedings have concluded before Mr. P. H. Drayton, K.C., at Toronto, to assess the damages alleged to have been sustained by the Logan brickyards, owing to the widening of Greenwood avenue by the city, north of the G. T. R. tracks. Mr. Logan claims $100,000, contending that the widening made the space on the high grounds in the yards so narrow that it was inadequate for the operation of the kilns, and for making driveways and storing fuel and brick. Counsel for the city, Mr. Geary, called Mr. L. W. McArthur, of Montreal, to give expert evidence, the latter being superintendent of three large plants. Mr. McArthur stated that there was no reason why a kiln should not be built on a slope. The award will be made by the arbitrator.

St. John, N.B., is to have a new hotel at a cost of a million dollars. The Imperial Hotel Company of St. John, Limited, was incorporated last week, with an authorized capital of one million, by C. H. Cahan, Jr., for St. John, and Montreal capitalists headed by Stanley Elkins, vice-president of the Canadian Manufacturers' Association; H. A. Powell, K.C., of the International Waterways Commission, and Rupert M. Rive. This company proposes to construct, equip and operate a first-class six storey hotel to be known as the Hotel Imperial. The plans, which have been prepared by Ross and MacDonald, architects, Montreal, who designed the Chateau Laurier, Ottawa, and the Fort Garry, Winnipeg, provide for more than 200 bedrooms, 125 of which will have private bath. The building will be fireproof and will stand on 30,000 square feet of land on the corner of King square and Sydney street, facing on King Square.

An announcement made a few days ago discloses the information that a large shipbuilding plant, with slipways, machine and construction shops, will be erected on the south shore at Vancouver, B.C., in the near future. The site of the proposed works is east of the old Moodyville mill, extending back a distance of 3,000 ft. and comprising an area of 92½ acres. The ground has been secured by the Dominion Shipbuilding, Engineering and Drydock Company, which proposes to build the works there. Preliminary arrangements have already been completed and borings for the site of the drydocks carried out. The entire plan when completed will cost practically $5,000,000. It is claimed that the new plant will be capable of building any type of vessel. A drydock with gates 100 ft. in width and 1,000 ft. long, capable of being added to later, have been provided for.

Apparently dissatisfied with the present arrangements for fire protection in Montreal the Canadian Fire Underwriters' Association have put forward the suggestion that the city should engage a body of competent engineers to prepare a report under their supervision. A deputation from the underwriters attended a recent meeting of the Board of Control and urged that an investigation of the water-works as they exist at present should be made, in consequence of the many fire losses sustained and the accident to the water conduit last December. The decision of the Board in the matter has not yet been disclosed.

The pumping plant at Toronto would appear to be in an unsatisfactory condition judging by a report submitted recently to the Toronto Board of Control by Commissioner Harris, who complained that the centrifugal pumps at the city's pumping station failed to comply with the terms of the contract as to construction, capacity and efficiency. Having endeavored without success to get the contractors to effect a remedy he now recommended that the city solicitor be instructed to proceed against the contractors and sureties for the fulfilment of the terms of the contract. The pumps were installed in November, 1909, by the Jens Orten Boving Company, who have been paid 90 per cent of the contract price. Four of the pumps are at the main pumping station on John street, and the other four at the high level station.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

Hamilton city council has approved the recommendation of the Building Inspector for the services of an assistant.

Woodstock, Ont., is to have a new City Hall at an expenditure of about $50,000. Plans have already been prepared by McBride & Gilbert, architects, London, Ont.

The Davis Shipbuilding and Repairing Company, Limited, has been incorporated at Ottawa, with a capital of $500,000, to carry on the shipbuilding business at Lauzon, Que.

The Warner, Quinlan Asphalt Company, Montreal, have a contract for paving work amounting to some $220,000. The job comprises seven and one-half miles of asphalt roads and fifteen miles of combination curb and gutter.

A six-ton motor truck of the Ontario Sewer Pipe Company, Swansea, carrying six tons of pipes, went through the Mimico Creek bridge a few days ago. The bridge is a steel frame structure, which was double-planked last fall.

The Toronto city council has decided to submit to the ratepayers during the second week in July, a by-law asking permission to expend $300,000 on motor buses. If passed an initial purchase of ten buses will be made, the number ultimately to reach a total of thirty-five.

A competition for plans for a new municipal building in Westmount, P.Q., is confined to architects or firms of architects on the Island of Montreal. The total sum to be spent on the new building is $150,000. The question of material or design is left entirely to competing architects.

The decision of the Canadian Wire & Cable Company to erect a plant at Leaside, Ont., at a cost of $1,600,000 is calculated to add greatly to the industrial importance of that district. The steel skeleton work on a large section of the building is at present under construction, and one unit of the building will be some 500 ft. in length.

Canadian architects will be invited to send in competitive plans for a public civic library to be erected at the corner of Sherbrooke and Montcalm Streets, Montreal. The building will cost $250,000. Other libraries are to be erected, and it is understood that the plans for the other libraries are to be of similar design. The prizes will be $1,000, $800 and $500 for the three best plans submitted.

At Montreal, Que., a ten-storey factory, estimated to cost about $1,000,000, is contemplated by the Henry Morgan Company, Limited. The location of the factory to be in the rear of the company's store on St. Catherine street west. The preparation of the plans is practically completed and the building will take the place of the present factory on the corner of Beaver Hall Hill and Victoria Square. It is intended to convert the present factory into offices for rental.

The contract for the construction at Toronto Island of a Ransome drifting sand filtration plant of 60,000,000 gallons daily capacity, has been given to the John ver Mehr Engineering Company, Limited, Toronto, the contract price being $1,066,282. The filtration plant is guaranteed with a cash bond of $250,000 to produce tasteless, colorless water 98 per cent bacteriologically pure and to require not more than one grain of chemical per gallon of treatment. The ver Mehr Company are prepared to commence installing the plant immediately and it is expected that it will be in operation by January, 1916. The company has guaranteed a removal of 90 per cent where there are organisms present to the extent of 50 to 500 per c.c.; 95 per cent where there are 500 to 2,000 present per c.c., and 98 per cent of all organisms where there are over 2,000 bacteria per c.c. present in the filtered water. It also guarantees a removal of 98 per cent. of B. Coli and of all turbidity, and the use of alum is not to exceed 1 grain per Imperial gallon under usual conditions.

It is stated in authoritative quarters that the United States Steel Corporation will in the near future erect in Canada a plant at a cost of $10,000,000. It is considered probable that the plant will be located at Montreal in opposition to Armstrong & Whitworth's plant now in process of erection on the south shore of the St. Lawrence. This action of the United States Steel Corporation, of which Mr. Andrew Carnegie is the head, is said to have been decided on quite recently.

Rapid progress has been made with the construction of the Cedars Rapids Manufacturing and Power Company's plant at Cedars, P.Q., by the contractors, Fraser, Brace and Company. It is expected that the Power Company will be ready to generate power by the end of this year. Concrete is being largely used in the construction of the power house. The work involves the excavation of over 1,000,000 cubic yards of earth and of about 700,000 cubic yards of rock. A large part of the machinery is being installed.

It is understood at Ottawa that the Dominion Government have decided to build the new Toronto Post Office on the site already acquired through expropriation. The post office will be on the corner of Adelaide and Victoria streets with the entrance on Adelaide street. It is proposed to erect a building on both streets 25 ft. back from the street line, and to utilize the space in front as a beauty spot. The building, which is expected to be one of the finest of its kind in Canada, will cost over a million dollars.

The building returns at Montreal show that from January 1 to May 31, 1914, the total value of building permits issued was $6,578,314, representing 1,823 buildings, as against, 1,577 buildings and a total value of $7,663,861 in the corresponding period last year. Both the number of permits issued and the value of building done during May of this year exceeds that for the corresponding month last year, the figures for 1914 being 716 permits valued at $2,517,148, compared with 655 permits and a total value of $2,473,608 in May, 1913.

The estimated cost of the new work on section 3 of the Trent Valley Canal, for which tenders have been called, is approximately $1,500,000. The section to be enlarged lies between Peterborough and Lake Simcoe, and the present contracts are all in progress. The announcement was made recently by the Minister of Railways and Canals that the entire waterway would be completed at the increased depth within four years. The lower sections between Hastings and the Bay of Quinte will be opened for traffic before the end of this year.

Plans for the Don section of the Bloor street viaduct have been inspected in private by the Toronto Board of Control. In the Don section there are five arches with 282 ft. between each. Provision is made for a 10 ft. 9 ins. walk, two 20-ft.

roads and two railways on the roadway which is 86 ft. across, over all. The railways are separated by a curb from the vehicular traffic routes. Telegraph, electric and other wires are provided for in conduits beneath the sidewalk. Tenders for the steel work will be called for at once and plans for the Rosedale section are practically completed.

WESTERN CANADA

The Marine Navigation and Engineering Company has been incorporated at Victoria, B.C., with a capital of $100,000, to carry on business at Vancouver.

The Saskatchewan Department of Public Works at Regina is advertising for tenders for the court house and land titles office to be built at Humbolt.

The Dominion government has awarded a contract to Janse Bros., for the building of a new elevator at Calgary, Alta., at a cost of $750,000. The elevator will have a capacity of 2,500,000 bushels.

It is rumored that the Roman Catholic diocese in Regina, Sask., has planned to erect 35 houses and a large church on the north side of Regina. This property is owned by the Roman Catholic church.

Messrs. James Brothers, Calgary, are the general contractors for a grain elevator to be erected in that city for the Dominion Government at a cost of $750,000. The capacity of the elevator will be 2,500,000 bushels.

Prince Rupert, B.C., is to have a new post office building at an estimated cost of $100,000. Tenders for the building close on July 6, with Mr. R. C. Desrochers, Secretary of the Department of Public Works, Ottawa.

The Saskatchewan Co-operative Elevator Company, with head office at Regina, is calling for tenders for the erection of a building at the corner of Eleventh avenue and Smith street, the estimated cost of which is $75,000.

The Provincial Public Works Department of British Columbia, has awarded to Messrs. Armstrong, Morrison & Company, Vancouver, the contract for a bridge over the Pitt River at Port Coquitlam. The estimated cost is $300,000.

Mr. F. Mollard, Secretary of the Little Manitou Rural Telephone Company with headquarters at Watrous. Sask., is calling for tenders for the supply of labor and material required for the building of the company's proposed telephone system.

Watson, Jacks & Anderson, of Nanaimo, are erecting a two-storey store and office building in that city for Mr. J. B. Nicholson at a cost of about $15,000. The building is of brick construction and was designed by Mr. A. Forrester, a local architect.

The Hon. Louis Coderre, Minister of Mines at Ottawa, has been advised that The Oil Processes, Limited, a British firm with a Canadian connection, contemplate the expenditure of more than $2,000,000 in an exhaustive search for petroleum in Northern Alberta.

The plant of the Kootenay Concrete Company, which is being launched at Rossland, B.C., has commenced operations. This plant has machines for the manufacture of building blocks, chimney blocks, pipes, ornamental work and concrete forms of various kinds.

The annual report of the Department of Mines of the Dominion Government [illegible] gina and Moose Jaw, and the district along the Alberta boundary in Saskatchewan is reported to offer a chance for oil operations." It is rumored in Regina that an oil expert will investigate the matter in the near future.

A branch of the firm of Wettlauffer Bros. of Toronto, manufacturers of concrete mixers, is being opened at Regina, Sask. Temporary quarters have been secured and the company will shortly erect a building of their own. This western branch will control all the business in Saskatchewan, Alberta, and British Columbia. The local manager is Mr. A. E. Hodgert.

The Board of Highways Commissioners for Saskatchewan is calling for tenders for the construction of a number of bridges, including two reinforced concrete abutments for a bridge over the Moose Jaw river south-west of Lang, and a reinforced concrete bridge and dam north of McTaggart; also a reinforced concrete sluiceway for a dam near Langenburg.

With the intention of enforcing the city building by-laws, Building Inspector Daly, of Medicine Hat, Alta., has notified prospective builders in that city that prosecutions will follow any infringement of the local building by-laws, which require the taking out of a permit from the office of the building inspector, and the submitting of plans showing proper sanitary arrangements.

In the Calgary oil fields it is expected that derricks of the largest type will soon be employed in boring drilling rigs. A report to hand states that a California oil man, Mr. Clyde Segur, has placed an order for five separate derricks with the Wendling & Nathan Lumber Company of Oregon. These derricks are to be 106 ft. high, constructed of the straightest and toughest Oregon pine.

Mr. J. E. Asquith, town engineer of Redcliffe, is planning sewer work to be done this year to cost $200,000. A trunk sewer on Broadway, and laterals on Third and Fifth streets are all that can be done this summer. The plans prepared by Mr. W. J. Francis, of Montreal, have been received, and when finally carried out will involve an expenditure of about half a million. The trunk sewer will be built of brick, and the laterals of sewer pipe made in this vicinity.

At Winnipeg, Man., a demonstration sewage disposal plant has been in operation for the last six months. The plant is the Dickson & Centrifuge system which is stated to be admirably suited to the Canadian climate, being completely housed and economically heated during the cold weather, so that freezing up is not possible. Captain Cecil Morgan, who represents the English Syndicate running the plant, has extended an invitation to Works Commissioner Harris, of Toronto, to visit the plant at Winnipeg.

The Provincial government recently considered tenders for the construction of the substructure of the new steel bridge across the Pitt River to connect the municipality of Coquitlam with Pitt Meadows. The successful tenderers were Armstrong, Morrison & Company, of Vancouver. The total cost of the bridge will be about $500,000, and the work will be completed within twelve months. The bridge will consist of seven open dredging caisson piers and two pile-bearing piers. The approach on the west end will be 300 feet long and on the east end, 465 feet.

The city council of Calgary, Alta., has decided to re-submit several of the by-laws which were defeated by the ratepayers in April and, in addition, a new by-law making a grant of $360,000 to the Exhibition Company for the erection of new buildings, improvement of grounds, etc. The by-laws to be re-submitted are as follows:—Parks, $50,000; electric light, $300,000; concrete sub-base for street railway, $90,000; publicity and receptions, $17,000. The total expenditure asked to be authorized is $807,000 and the five by-laws will go to the people on June 26.

It was announced at Ottawa recently that the Dominion government would establish an Astronomical Observatory at Victoria, B.C., to supplement the Government Astronomical work heretofore done at Ottawa. Details of the equipment to be installed have not yet been announced but the site has been selected at Saanich Hill, north of the city proper, and

It is understood that contracts for both the lenses and chemical parts have been awarded. The house is a circular building of steel construction with walls 30 ft. high and surmounted by a revolving dome 60 ft. in diameter.

A scenic road is being built from Revelstoke, B.C., up Mount Revelstoke to Victoria Park on its summit. Commencing on the western boundary of the city, at an altitude of 1,450 feet, with the aid of five switchbacks, the road reaches the summit, 12.8 miles distant, at an altitude of 6,150 feet. Upon completion of the road the Canadian Pacific Railway contemplates the establishment of an automobile service connecting its hotel at Revelstoke with the chalet at the summit, which is to be constructed by the company. The average grade of the road is 6.6 per cent and the maximum grade 7.6 per cent. The park on the summit consists of a plateau of some 70,000 acres.

A vaudeville theatre will be erected in Regina, Sask., within the next few months. The theatre, which will be known as the "Empress," will be built by Mr. William Milne of Regina, on the property immediately north of the Metropole Hotel on Rose street. It will have seating accommodation for about 1,000 persons. Plans of the building have been prepared by Messrs. Tripp & Rowley, architects, Regina, and it is expected that excavation will be commenced without delay. The building will be of steel frame and reinforced concrete, and fireproof throughout. A unique feature of the theatre will be the finish of the hallways, foyers and stairways, which will be of fancy tiled brick. The building, the cost of which will be about $65,000, will have a breadth of 50 feet and a depth of 125 feet.

Some interesting particulars bearing upon the constructional development of Dawson City, Yukon, have been received at the office of this journal. The population of the town is 2,000, it having remained stationary during the last few years. The assessment is, roughly, two million dollars and the tax rate for the present year is 18 mills. There are approximately eight miles of gravelled roads and there will be an expenditure of $14,000 on road work this season. The sewerage system consists of box sewers emptying into the river. Sewer extensions are planned at a cost of $2,000. The garbage is collected in carts and dumped into the Yukon river. Water is obtained from the Klondike river and filtered before being pumped through the mains. Water-works extensions contemplated involve an expenditure of $65,000. The installation of an electric light plant is planned by the corporation. The Superintendent of Works and Buildings for Dawson City is Mr. Isaac Lusk.

Greater Winnipeg Water Supply

In connection with the city of Winnipeg's scheme for bringing a water supply from Shoal Lake, at a cost of $13,000,000, it is of interest to note that the most expensive part of the undertaking, the preliminaries of which are now well advanced, will be the construction of the aqueduct. The estimated cost of this is $8,729,000, the various items making up this total including the following:

Earth excavation, west of Summit cut, 1,880,000 cu. yds., at 60 cts.	$1,116,000
Earth excavation, in Summit cut, 1,100,000 cu. yds., at 75 cts.	825,000
Rock excavation, 94,000 cu. yds., at $2.50	235,000
Refill and embankment, 2,300,000 cu. yds., at 40 cts.	920,000
Concrete, 340,000 cu. yds., at $13	4,420,000
Reinforced concrete, 29,000 cu. yds., at $17	493,000
Timber platform, 13,000 ft., at $40	520,000
Steel for reinforcing aqueduct	70,000
Special work near river crossing	80,000
Gate and screen chamber and other work at intake	50,000

Surveys for the aqueduct were conducted during the winter. The frozen ground facilitated this work and it was possible to locate the line approximately on the preliminary alignment through a country almost impenetrable except in winter. A section 37 miles long was run between two points 38 miles apart, with a deviation of not more than 3 miles from the air line. A uniform grade of 0.7 ft. per thousand was secured, except at two small river crossings. About 60 per cent of the country through which the location has been made is covered with small timber. Half of the distance is in muskegs. For the greater part of the length the aqueduct will be uniformly covered by a fill 4 ft. deep and it is believed that the invert will be at all points in hard ground below the swamp stratum. The administration board will have constructed typical sections of the aqueduct for testing and exhibition purposes. The board also has decided to supply all gravel, sand and cement to be used in the construction f. o. b. cars near site of the work.

The construction of the Shoal Lake water supply system is in charge of the Commissioners of the Greater Winnipeg Water District. S. H. Reynolds is chairman of the Commission, which has its main office at 901 Boyd Building, Winnipeg.

The survey parties engaged in exploration and location of the aqueduct line have been in charge of George F. Richan, Arch. Paget, Douglas I. McLean, A. C. D. Blanchard and Charles J. Bruce. Max V. Sauer is Chief of Designs in the Winnipeg office.

Canadian Railroad Development

The new Lake Shore line of the C. P. R. will probably be in readiness for passenger traffic in the course of a few weeks. This line will give practically a new route between Montreal and Toronto.

According to an announcement made a few days ago by Mr. T. C. Martin, passenger agent of the T. H. & B. Railway, arrangements have been completed for the construction of a branch line from Smithsville to Dunnville. The work will be started very soon.

Work is proceeding on the grade upon which steel will be laid to the terminal grounds of the Hudson Bay Railway, beginning at The Pas, a point south of the bridge across the Saskatchewan River. Two tracks will be laid, one to the round house and the other to connect with the C. N. R. about a mile south of the present station. The plans call for 14 tracks, with a capacity of 1,600 cars. Of these tracks 8 will be laid immediately and the balance as necessity requires.

The electrical specialties manufactured by Messrs. Gent & Company, Limited, Leicester, Eng., are described in a number of carefully-compiled, well-illustrated booklets, neatly secured under one stiff cover, received at the office of the Contract Record and Engineering Review. A particularly interesting catalogue is that of water level and sewage recording apparatus. Many important installations of this apparatus have been made by H. M. Government and by many large corporations, not only in the old country, but throughout the world. Another interesting booklet is that descriptive of the Pulsynetic system of electric impulse clocks. This system has been installed throughout the "Aquitania," Britain's largest liner. Copies of the firm's publications may be seen at the Toronto office of the Contract Record or obtained directly from Messrs. Gent & Company, at Faraday Works, Leicester Eng.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Athabasca, Alta.

Plans are being drawn by the town council for the construction of a reinforced concrete reservoir with a capacity of 100,000 gallons. Engineer, C. L. Huff.

Arthur Twp., Ont.

Tenders will be received by the township clerk, Albert Hellyer, Kenilworth P.O., Ont., until 2 p.m. June 23rd, for the construction and completion of drains Nos. 5 and 6. Plans and specifications are at the office of the clerk.

Contrecoeur, Que.

Tenders for the construction of macadam roadway will be received by the secretary-treasurer to the municipal council until June 27th.

Cayuga, Ont.

Tenders addressed to the town clerk, J. W. Sheppard, will be received until June 24th, for cement pavements. (1) King St. to Norton St., excavation 250 cu. yds., tile drains, 1,500 lin. ft., curb 1,600 lin ft., pavement, 2,200 sq. yds., catch basins, 4; (2) Ouse St. to Munsey St., excavation 420 cu. yds., tile drains 2,200 lin. ft., curb 2,248 lin. ft., pavement 3,300 sq. yds., catch basins 4.

Drummondville, Que.

Tenders will be received by the town clerk, W. A. Moisan, until June 19th, for the construction of sewers in the east ward. Plans and specifications are at the office of Gauvin & Beauchemin, C.E., Quebec Rly. Bldg., Que., and with the town clerk.

Edmonton, Alta.

The city council has decided to purchase a paving plant at an estimated cost of $25,000. Engineer, A. J. Latornell.

Gloucester Twp., Ont.

Tenders for drainage will be received by the township clerk, H. B. Billings, Billings Bridge, Ont., until June 20th. The work consists of 81,011 cu. yds. earth excavation; 2,297 cu. yds. hard pan; 405 cu. yds. rock; 41,498 cu. yds. B.M. cedar in culverts; 1,200 rods of fence.

Kingston, Ont.

Tenders will be called shortly by the town council for the construction of 50,000 sq. yds. of sheet paving on various streets, with concrete or macadam base.

The engineer, R. J. McClelland, has been instructed to procure prices for a plant for laying sheet paving.

Montreal, Que.

Tenders will be received by the Board of City Commissioners, Waterworks Department, until noon June 23rd, for renewing the roofs of the oiler houses and pump buildings, also for removing the old wooden structure. Plans and specifications are at the office of the Superintendent of Waterworks City Hall.

Ottawa, Ont.

The city council has decided to purchase an asphalt surface heater, fire wagons, tar pots, dampers, also a drain cleaning apparatus for the works department. Tenders will be called shortly.

The purchase of 12 automatic flushers is also being considered.

Plans have been drawn by the city council for the construction of the following pavements. Wood block on Chapel St. between Clarence and Rideau Sts., $17,300; wood block, 3,682 sq. yds., curb and gutter 10 lin. ft., gutter 1,995 lin. ft., headers 100 lin. ft. Asphalt on Kent St., between Wellington and Catharine Sts., $46,272, asphalt 13,324 sq. yds., gutter 8,552 lin. ft., headers 300 lin. ft. Murray street, wood block 2,141 sq. yds., gutter 1,606 lin. ft., curb 1,204 lin. ft., headers 35 lin. ft.

The city council will probably shortly call for tenders for an 8-ton asphalt roller.

Pembroke, Ont.

Plans are in progress for extensions to the waterworks system. The town council will receive prices on cast iron pipe, specials, hydrants and valves.

Port Coquitlam, B.C.

A by-law providing for the expenditure of the sum of $100,000 on road improvements has been passed by the ratepayers.

Regina, Sask.

The tenders for the construction of storm and domestic sewers are in. The contracts will not be awarded before the next council meeting on June 23rd.

Sherbrooke, Que.

Plans for grading on King Hill and street, are at the office of the secretary, E. C. Gatien, 57 Wellington, who will receive tenders until June 25th. Engineer, Thos. Tremblay, 37 Wellington Street

Toronto, Ont.

Tenders will be received by the Board of Control until June 23rd for the construction of asphalt pavements, 4 streets; bitulithic pavements, 7 streets; concrete pavements, 2 streets; concrete curbings, 1 street; concrete walks, 25 streets; grading, 4 streets.

Tenders will close with the Board of Control June 23rd, for the supply of 2 tandem steam road rollers. Specifications, etc., are at the office of the Purchasing Dept., Room 12, City Hall

The Commr. of Works has recommended that by-laws be submitted for the construction of the following:—Asphalt plant, $125,000; sewers, $121,400; Dundas St. bridges, $148,000; North Toronto water supply mains, $525,000; high pressure extensions, $500,000; general water mains, $315,000

Tenders close with the Board of Control on June 23rd, for the construction of sewers on 17 streets, 6 lanes and West Toronto Sewer System Div. No. 2, stand by tank.

After discussion on the proposed construction of a sewer system for North Toronto, the city council decided to defer action for the present. The location of the disposal plant was considered unsatisfactory.

The erection of a new building in St. Andrews Market for the use of the Waterworks Department is proposed by the city council. The estimated cost is $100,000.

Windsor, Ont.

The ratepayers have authorized the expenditure of $30,000 for paving Walker Rd. to Oldcastle.

CONTRACTS AWARDED

Brantford, Ont.

The following contracts have been awarded in connection with the extensions to the waterworks system. P. H. Secord & Sons, Ltd., 133 Nelson St., for extension to the fireproof pump house, at $4,170; Turbine Equipment Co., of Toronto, and Waterous Engine Works, Market St. S., Brantford, for two 4-million gal. Booster pumps, motor-driven, and two 4-million gal. steam turbine pump, at $31,930.

Berlin, Ont.

The following contracts for the construction of pavements on Water, Webber and Victoria streets have been awarded by the city council: The Canada Creosoting Company of Toronto, for about 11,000 sq. yds. creosoted wood block pavement, at $3.10 per sq. yd. and the Warren Bituminous Paving Company of Toronto, for about 10,000 sq. yds. bitulithic pavement at $2.55 per sq yd.

Ft. William, Ont.

Contracts for the construction of macadam roadways have been awarded by the city council to Stewart & Hewitson, 20 Cumberland St. N., Port Arthur, at $123,000, Rocmac Ltd., Port Arthur, at $72,000.

A contract for the construction of asphaltic concrete pavements has been awarded by the city council to the National Paving & Contracting Company, of Winnipeg.

Contracts have been awarded by the city council to Stewardson Bros., S. Archibald St., for the construction of 5 concrete sewers, and to Hannla & Hermonson, 225 Robertson St., for tile and concrete sewers.

Levis, Que.

A contract has been awarded by the town council to the Lauzon Engineering Co., 127 Commerciale St., for the construction of 6,340 sq. yds. paving with "medal" vitrified brick at $4.64 per sq.

[illegible] and [illegible] ft. stone border at 80 cents per ft.

London, Ont.

A contract has been awarded by the city council to Foley & Gleason, of Central Chambers, Ottawa, for the construction of vitrified brick pavement on Ridout street at $2.[illegible] per square yard.

Ottawa, Ont.

A contract for the construction of pavements on various streets has been awarded by the city council to The Union Construction Co., Bank St. Chambers.

St. John, N.B.

The contract for the supply of pipe has been awarded by the city council to the Jas. Robertson Company of Charlotte Street.

Sudbury, Ont.

The town council has awarded to the Warren Bituminous Paving Company, of Toronto, the contract for the construction of bitulithic pavement to be laid on a 6-in. stone concrete base, at $2.65 per sq. yd.

Swift Current, Sask.

The following contracts have been awarded by the town council. Mannesmann Tube Company, of Montreal, for cast iron and steel pipe with specials, at $7,566.75; Rensselair Valve Company, of Troy, N.Y., for hydrants, gate valves and boxes, at $1,741.25.

Toronto, Ont.

The Board of Control has awarded to E. J. Hartnett, 17 Lumbervale Ave., a contract for grading Humber River driveway.

The contract for the construction of the filtration plant at the Island has been awarded by the Board of Control to the John VerMehr Engineering Company, of London, Eng., and Toronto, in conjunction with Wm. Cowlin & Sons (Canada) Ltd., Bristol, Eng., and Toronto. $1,066,282.

Victoria, B.C.

The municipal council has awarded to Warren Bros. Company, of 918 Government St., the contract for the supply of a paving plant, at $12,729, with an oil-burning attachment, $776.

Welland, Ont.

The town council has awarded a contract to J. G. Mill, 57 Victoria St., Toronto, for the construction of sewers in Elm St., at $1,164.84, and Wilton Ave., at $1,040.78.

Wallaceburg, Ont.

The following contracts have been awarded in connection with the waterworks system. Laying mains, James Makioski; laying distribution service and sewers, G. B. Moogk, Weston, Ont.; pump station, McGregor & Rankin, c/o the town clerk; water tower and fountain, Huter Bridge & Boiler Company, of Campbellford, Ont. (Agent, J. C. Keenan, Traders Bank Bldg., Toronto); cast iron pipe, National Iron Works, Ltd., of Toronto; fire hydrants, Canadian Allis-Chalmers Ltd., of Toronto; valves, Drummond McCall & Co., of Montreal; water filter, American Water Softner Company, of Philadelphia, Pa.; pumping machinery, Canadian Fairbanks-Morse Co., of Toronto; intake and basin and river crossings, A. O. Thrasher Company, of Toledo, Ohio; steel pipe for force mains, Factory Products Ltd., of Toronto.

Winnipeg, Man.

The Board of Control has awarded to Henry Martin, 438 Mackay Ave., a contract for the construction of the Spruce street sewer.

The following contracts have been awarded by the Board of Control. E. F. Campbell, Supt. Asphalt No. 2 City Yards, sewer in Doreen St., at $792.50; J. W. Astley, Engineer of Construction, City Yards, sewer at $2,938, and watermain at $272.04 in Sanford St.

The following contracts have been awarded by the Greater Winnipeg Water Dist. Commrs. (19) J. J. Carruthers, of Edmonton St., for the erection of a bungalow, at Shoal Lake, Man.; (20) W. M. Scott, of Sterling Bank Bldg., for the construction of the exhibition sections of the aqueduct; (22) James Morris, of Fountain St., for well drilling at the reservoir site.

Winnipeg, Man., Transcona.

The following contracts have been awarded by the town council: (2) Canada Iron Corporation, Mark Fisher Bldg., Montreal, for cast iron pipes; (3) J. S. Neilson Co., 66 Argyle St., Winnipeg, for hydrants; (3a) McAvity & Sons, St. Johns, N.B., for valves and valve boxes; (6) Economy Foundry Co., Ltd., 916 Somerset Bldg., Winnipeg, for sewer castings; Manitoba Engineering & Construction Co., Winnipeg, for construction.

Railroads, Bridges and Wharves

Calgary, Alta.

The proposal of the Canadian Northern Railway Company to erect a $250,000 station here has been abandoned.

Edmonton, Alta.

C. F. Law, of Athabasca Landing, is making surveys on behalf of D. T. Thomas, of Cardiff, Wales, for the proposed construction of a railroad in the Peace River district, in the north of Alberta and B. C., which will connect with the steamship line on MacKenzie River.

Hamilton, Ont., Burlington

Tenders for the construction of a revetment wall close with R. C. Desrochers, Public Works Department, Ottawa, July 6th. Plans and specifications are at the office of J. G. Sing, Toronto, Dist. Supt., Windsor, and Postmaster, Burlington.

Moncton, N.B.

Plans for the construction of a 40-stall round house have been prepared by the Department of Railway and Canals, Ottawa.

Notre Dame de Lourdes, Que.

Tenders or the construction of a concrete and steel bridge, estimated to cost $12,000, will be received by the Mayor, Eugene Bedard, until June 30th. Plans and specifications are at the office of the engineer in charge, L. A. Vallee, 80 St. Cyrille.

Nanaimo, B.C.

Plans for the construction of the Millstream bridge are being prepared by the city council. The estimated cost is $16,000.

St. Catharines, Ont.

Tenders will be received by L. K. Jones, Department of Railways & Canals, Ottawa, until June 26th, for the construction of a stone protection on the summit level between Thorold and Port Colborne-Welland Canal. Plans are at the office of the Superintending engineer, St. Catharines, and the chief engineer of Department, at Ottawa.

Weyburn, Sask.

The necessary by-law having been passed, plans are being prepared for the construction of a steel bridge at Third street, at a cost of $15,000.

Woodstock, N.B.

The St. John & Quebec Valley Railway are about to call for new tenders for the erection of a station.

Woodstock, Ont.

Plans, etc., are at the office of the county clerk, N. E. Burtch, Court House, who will receive tenders until 10 a.m. June 20th, for the supply and construction of abutments and steel superstructure for a 40-ft. span over Hamars Creek.

CONTRACTS AWARDED

Ft. William, Ont.

The harbor dredging contract has been awarded by the Public Works Department to J. Whalem, of Port Arthur.

Kitsilano, B.C.

The bridge contract has been awarded by the British Columbia Elec. Rly., Ltd., to J. Coughlan & Sons, of Pender and Beatty Sts., Vancouver.

Nanaimo, B.C.

The dredging contract has been awarded by the Public Works Department to the Pacific Dredging Company, 734 Granville St., Vancouver.

Ottawa, Ont.

The General Improvement & Contracting Co., Ltd., of 36 Prince St., Montreal, has secured the contract for dredging at the upper entrance of the Soulanges Canal.

Toronto, Ont.

The following contracts on the construction of 2 bridges have been awarded by the Ontario and York county authorities. Steel, Standard Steel Constr. Company, of Welland, Ont., $1,235; concrete, McDougall & Toole, of Midland, Ont., $2,650.

Public Buildings, Churches, Schools, etc.

Beamsville, Ont.

The by-law providing for the erection of a high school on King street has been defeated by the ratepayers.

South Edmonton, Alta.

The plans for the proposed Sons of England hall have been approved. Hardie & Martland, Victoria Block, are the architects. Two additional storeys may be added later.

Exeter, Ont.

Tenders for the erection of a public library will be received by H. E. Huston, secretary to the Public Library Board, until June 20th. Plans and specifications are at the Library Building. Estimated cost $12,000.

Grosse Isle, Que.

Tenders for the erection of a detention building will be received by R. C. Desrochers, Public Works Department, Ottawa, until 4 p.m. July 2nd. Plans, etc., are at the office of J. A. Tremblay, Dist. Engineer, Montmagny, Que., A. Dupuis, Dist, Engr., Quebec City, and at Department, Ottawa.

Indian Head, Sask.

Permission has been granted by the Provincial Government to raise the sum of $18,000 for the erection of ·a high school.

Kenora, Ont.

The sum of $20,000 has been included in the Government estimates for the erection of a drill hall.

Lethbridge, Alta.

Lees & Gigler, of 502 Tegler Block, Edmonton, who have the general contract for the erection of the new separate school are inviting tenders for all subtrades except mason and carpenter.

London, Ont.

Tenders for decorating the interior of the Centennial Methodist Church close with the secretary, T. R. Wright, 950 Princess St., on June 20th.

Midland, Ont.

Plans are in progress and separate tenders will be called shortly for all trades connected with the erection of an 8-room school. Architect, John Wilson, Hurontario street, Collingwood.

Milton, Ont.

Plans are being prepared for the erection of a registry office. The architects are Geo. N. Molesworth and Gordon M. West, 2 College Street, Toronto.

Medicine Hat, Alta.

Tenders for alterations and additions to the public building will be received by R. C. Desrochers, Public Works Department, Ottawa, until 4 p.m. July 6th. Plans, etc., are at the offices of Mr. Thos. Tyler, Caretaker, Public Building, Medicine Hat, Mr. Leo. Dowler, architect, Calgary, H. E. Matthews, Supt. Architect of Dom. Public Bldgs., Winnipeg, and at Dept., Ottawa.

Montreal, Que.

Tenders for the erection of a church on Dorchester St. W. for St. George's Parish, are invited by the architects, Barott, Blackader & Webster, New Birks Building.

A competition will probably be held shortly for plans for the proposed public library, on Sherbrooke and Montcalm Sts. The prizes will be 1st, $1,000; 2nd, $500; 3rd, $300. Secretary to the Board of Commissioners, L. N. Senecal.

The time for receiving tenders for the erection of the Synagogue on St. Urbain St. for The Adath Yeshurun has been extended to June 20th.

Montreal, Que., Notre Dame de Grace

Tenders for the erection of the School for the Blind, on Sherbourne St., are in; if work is to go ahead, contracts will be awarded shortly.

Montreal, Que., Verdun

Sketches for the erection of a club house on Church Ave., for the Verdun Athletic Club, are about to be submitted by D. J. Spence, 46 Beaver Hall Hill; if satisfactory, plans will be made at once.

Plans for the erection of a fire station were approved of at the last council meeting. Tenders will probably be called shortly.

Niagara Falls, Ont.

Plans have been prepared for the erection of a church and Sunday School (accommodating 600 and 500 respectively) for the Morrison St. Methodist Church. The trustees have not yet decided when tenders are to be called. Bond & Smith, Wilton Ave., Toronto, are the architects.

Oakville, Ont.

The erection of a post office, customs house and armory, at a cost of $40,000, is contemplated by the Public Works Department.

Prince Rupert, B.C.

Tenders will be received by R. C. Desrochers, Public Works Department, Ottawa, until 4 p.m. July 9th, for the construction of a third-class detention building. Plans, etc., are at the office of Wm. Henderson, Res. Arch., Victoria, and at Dept., Ottawa.

Tenders for the erection of a post office will be received by R. C. Desrochers, Public Works Department, Ottawa, until 4 p.m. July 6th. Plans, etc., are at the offices of G. B. Hull, Dist. Engr., Prince Rupert, Wm. Henderson, Res. Arch., Victoria, and at Dept., Ottawa. The estimated cost is $100,000.

Regina, Sask.

It is proposed to erect a new church on Dewdney Avenue for the R. C. denomination.

Toronto, Ont.

The board of the W. C. T. Union has decided to get estimates for the addition of one storey to Willard Hall, Gerrard Street East. Miss Grant is the Secretary-treasurer.

The Property Committee of the Board of Education has passed plans for an 8-room addition to Brown School, and a 6-room wing addition to Franklin School. Tenders will be called shortly.

Supt. Bishop recommends the purchase of 5 acres at the corner of Bloor and Jane Sts., for the erection of a new school building.

Tenders for the construction of the basement for the Church of the Advent, West Toronto, will be received by the architects, Gordon & Helliwell, Confed. Life Building.

The Board of Control has decided to call tenders for both brick and concrete construction for the erection of cottage No. 2 at the jail farm north Yonge St. Estimated cost $50,000.

The city council has passed the recommendation of the Street Commissioner to purchase 442 acres for a site for the erection of new stables and a garbage disposal station.

Toronto, Ont., Mount Dennis

Plans are to be prepared for additions to Mt. Dennis Methodist Church, at a cost of $5,000. Chester Legrow, Weston Road, is the architect.

Toronto, Ont., Mimico

The town council has instructed the clerk to get estimates for the construction of an incinerator.

Tenders will soon be called for the erection of a public library. S. B. Coon & Son, of the Ryrie Bldg., Toronto, are the architects.

Wabanum, Alta.

The Public School Board propose to call tenders for the erection of a school building.

Windsor, Ont.

Plans for the erection of an abattoir for Salzenstein Bros., are being drawn by J. C. Pennington, La Belle Bldg. The ratepayers will be asked to vote on a bylaw to grant a site.

Winnipeg, Man., Kildonan

Tenders for the erection of a new church for Kildonan Presbyterian Church congregation will be received by S. R. Henderson, 701 Confed. Life Bldg., Winnipeg, until June 21st. Architects, Bayne & Hobbs, 213 Chambers of Commerce, Winnipeg.

Winnipeg, Man., West Kildonan

Tenders will be called shortly for the erection of a fire hall. The estimated cost is $13,500.

CONTRACTS AWARDED

Edmonton, Alta.

The contract for additions to McCauley Street School has been awarded by the Public School Board to Pheasey & Batson, Alexandra Block.

North Edmonton, Alta.

The Public School Board has awarded to Doyle-Thomas & Christensen, of 2nd Street, the contract for school additions.

Eel River Reserve, N.B.

The school contract has been secured by Jas. A. Goulet, of Charlo Station, N.B.

Gravenhurst, Ont.

The general contract for the erection of a recreation hall for the Muskoka Free Sanitarium, has been awarded to A. C. Ferguson, Gravenhurst, and that for plumbing and heating, to Bennett & Wright, of Queen St. E., Toronto.

London, Ont.

The contract for addition to the Dufferin Ave. Collegiate has been awarded by the Board of Education to S. Willis, Talbot and Oxford streets.

New Waterford, C.B.

The contract for the erection of the new Presbyterian Church has been secured by the Rhodes Curry Company, of Amherst, N.S. The contract includes all trades.

Port Elgin, Ont.

A contract for the erection of a school and residence has been awarded by the Dept. of Indian Affairs, to Gilpin Bros., of Wiarton, Ont.

Ruskin, B.C.

The Dewdney Dist. school contract has been awarded by the Public Works Department to B. E. Tucker, $5,950

Stratford, Ont.

The incinerator contract has been awarded by the city council to the A. D. Reid Incinerator Company, of Standard Bank Bldg., Toronto.

Sussex, N.B.

The contract for the erection of the

[illegible] on Main St. and Magnolia Ave., has been let by the Public Works Dept to [illegible] McArthur, of Coldbrook, N.B.

St. John, N.B.
The contract for the erection of the new instrument tower at the observatory has been awarded to the Union Foundry Company, of St. John St. W.

Toronto, Ont.
The following contracts have been awarded by the Board of Education on Strathcona Ave. School. Plumbing, R. Jordan, 37 Hazelton Ave., $945; heating and ventilating, J. R. Seager, 799 College St., $1,937; electric wiring, Bennett & Wright, Queen St. E., $186.

West Burnaby, B..C
The Broadview School contract has been awarded by the School Board to C. J. Smalley, Cedar Cottage, $8,475.

Wetaskiwin, Alta.
The Public School Board has awarded to Johnson & Couglin, of Camrose, the contract for heating and ventilating in Alexandra School.

Winnipeg, Man.
The sub-contract for the installation of a ventilating apparatus at the law courts has been awarded to B. F. Sturtevant, of Galt, Ont.

The contract for the erection of two comfort stations, on Fort and Garry Sts., has been awarded by the Board of Control to J. W. Astley, Engineer of Construction, City Yards.

A contract has been awarded by the Board of Control to S. K. Karper, 527 Notre Dame Ave., for replacing wooden floors with concrete in 7 fire stations.

Business Buildings and Industrial Plants

Arnprior, Ont.
Plans for alterations and additions to the hotel premises of John Cunningham, are being drawn by F. C. Sullivan, Castle Bldg., Ottawa.

Chats Falls, Ont.
The erection of a summer hotel, at a cost of $75,000, is proposed by the Chats Falls Railway Company. Director, W. Jaynt, Hillson Ave., Westboro.

Edmonton, Alta.
The building of the auditorium has been postponed.

Nothing will be done this year in regard to the proposed erection of a $250,000 theatre on 2nd Street, by Geo. Brown.

Plans for the erection of a garage on 25th St., for M. H. McCray, are being drawn by Cauchon & Vantyne, Hart Block. Tenders will be called shortly.

Tenders will be called immediately for the erection of a club and apartments block on 2nd and Victoria Ave., for the Northern Club, Jasper Ave. Architects, Magoon & MacDonald, Tegler Block. Estimated cost $250,000.

Tenders will be called shortly for the erection of a hotel for W. H. Connor, Queen and Rice St. Geo. Trust, 22 Victoria Block, is the architect.

South Edmonton, Alta.
Tenders on the erection of store and offices, on Whyte Ave. E., are invited by Geary Bros., Whyte Ave., or the architects, Willson & Herald, Credit Foncier Block, Jasper Ave.

Hamilton, Ont.
The erection of a rubber factory is proposed by the National Rubber Company, Ltd. The architect is not yet appointed.

Lachute, Que.
The Lachute Knitting Company will immediately commence rebuilding their plant which was recently destroyed by fire.

Montreal, Que.
Tenders for the erection of the $100,000 factory for Tuckett Tobacco Co., Ltd., 379 Craig St. W., are still open. The architects are Stewart & Witton, 7 Hughson St. S., Hamilton, and Brown & Vallance, Southam Bldg., Montreal. Tenders addressed to the former will close shortly.

Tenders for separate trades on alterations to stores on Jacques Cartier Sq., are invited by the architect, Thos. Daoust 26 St. James St.

A permit for alterations to store on 118 St. Catherine W., at a cost of $7,000, has been granted to J. O. Gravel, 50 Notre Dame W.

Montreal, Que., Maisonneuve
The branch of the Bank of Montreal will not be built this year.

Ottawa, Ont.
Plans for the erection of stores and apartments on Somerset St., at a cost of $80,000, have been drawn for John Fixter, et al, by Weeks & Burgess, Sparks St.

Owen Sound, Ont.
The ratepayers have carried by-laws granting (1) Bonus of $10,000 per year for 20 years to a shipbuilding concern; (2) $60,000 loan to the Union Cement Company; (3) Exemptions for 10 years to the Canada Yeast Company.

Regina, Sask.
The erection of a $50,000 warehouse is being considered by Thos. Ryan & Co., of Winnipeg.

A site for the erection of a flour mill has been secured by the Leitch Bros. Milling Co., of Oak Lake, Man.

Sudbury, Ont.
Plans for the erection of a warehouse for the Cochrane Hardware Company are with the architects, Angus & Angus, Room 8, Desrosier Bldg., who will receive tenders until June 20th for all trades, except excavation, for the erection of 3-storey warehouse and basement and for alterations to the present buildings. A $2.00 deposit will be required for plans and specifications taken out of the office.

Sackville, N.B.
Plans for the erection of an opera house and stores are being drawn for M. Wood & Son, Bridge Street, by W. W. Doull.

Toronto, Ont.
It is proposed to erect an office building for the Board of Trade and a committee has been appointed to select suitable plans.

The erection of a store and apartments on Yonge and Heath Sts., is proposed by J. M. Skeleton, Kent Bldg. The large house on the site is to be removed.

Winnipeg, Man.
A. H. S. Murray, 300 Garry Bldg., has abandoned his project to erect stores on Sherbrooke and Wolseley Streets.

CONTRACTS AWARDED

Brandon, Man.
The following sub-contracts connected with the erection of a warehouse on North Rosser Ave., for the Brandon Grocery Co., have been awarded. Roofing, Can. Sheet Metal Works, Winnipeg Ave., Winnipeg; heating, C. D. Kirk Co., 774 McMillan Ave., Winnipeg; electrical, Shipman Elec. Co., 396 Portage Ave., Winnipeg.

Beebe, Que.
The contract for the erection of a business block, on South Main St., for Dr. R. A. Getchell, has been secured by Wm. Bissell.

Galt, Ont.
The following sub-contract has been awarded in connection with the erection of stores, offices and lodge room, on Water St. N., for I. K. Martin and Dr. Barrett. Plastering, Jas. Moore, E. Main street.

Hamilton, Ont.
The following contracts have been awarded on the erection of 8 stores and apartments on Mary St., for H. S. Brennan. Masonry, W. H. Cooper, 67 York St.; carpentry, J. Poag & Son, Westinghouse Ave.; roofing, J. E. Riddle & Son, Ferguson Ave. N.; plastering, Hill Bros., 303 Emerald St. N.; painting, Stamp & Son, King William and Mary Sts.; heating and plumbing, Goodram Bros., 248 King St. W.

Regina, Sask.
The contract for the erection of a store on 11th Ave., for the F. W. Woolworth Company, New York City and Toronto, has been let to Thos. Barnard, Westmann Chmbrs.

Shawinigan Falls, Que.
The contract for the foundations for the extensions to the paper mill of The Belgo-Canadian Pulp & Paper Company, has been let to Raymond Concrete Pile Company, of New Birks Bldg., Montreal.

Toronto, Ont.
The contract for the erection of a warehouse, on McCaul, for A. B. Rosenblott, has been let to Thos. Essery, Confederation Life Bldg.

Toronto, Ont., Mt. Dennis
The contract for the erection of the Canadian Kodak Company's factory has been secured by C. E. Deakin, of 41 Mayor St., Montreal.

Winnipeg, Man.
The contract for alterations to the Olympia Cafe Company's premises on Donald St., has been let to Wallace & Aikens, Somerset Bldg.

Residences

Brantford, Ont.
Gilbert Brereton, 160 Brant Ave., has decided not to build a residence on Brant avenue.

Charlottetown, P.E.I.

The erection of a large residence, on Mt. Edward Rd., by J. R. Dinnis, is postponed. Building may not start until next summer.

Edmonton, Alta.

Plans for the erection of a $10,000 residence on the Glenora sub-division are being prepared by F. Martin, 49 Arlington Apartments.

Plans for the erection of a $10,000 residence for Mr. Percy Abbott, are being drawn by Van Siclen and Macomber, Alexander Block.

Hamilton, Ont.

G. V. Taylor, of 91 Victoria Ave. S., proposes to make certain alterations and additions to his premises at a cost of $15,000. A. W. Peene, Clyde Block, is the architect.

Montreal, Que.

The erection of a residence on Harvard street for Dr. Globinsky, has been postponed for the present.

A permit for alterations to the residence, at a cost of $12,000, has been granted to Ernest Archambault, 1319 St. Hubert.

Plans for the erection of a $10,000 residence, on Pt. Claire Rd., for L. E. Taillon, are being prepared by Theo. Daoust, 26 St. James St., who will receive tenders for general contractor.

Montreal, Que., Outremont

Plans for the erection of a $20,000 apartment house, on Van Horne St., has been drawn for Mr. J. W. Gauthier, by S. Frappier, 2238 Park Ave., who will call tenders in about one week.

Montreal, Que., St. Henry

Plans for the erection of flats on Beaudoin St., at a cost of $25,000, are being drawn by Theo. Daoust, 26 St. James St., who invites tenders for general contractor.

Montreal, Que., St. Lambert

Plans for the erection of a $6,000 cottage, for G. H. W. Chandler, 68 Laurier W., Montreal, have been drawn by S. Frappier, 2238 Park Ave., who is now open to receive tenders for general contractor.

Montreal, Que., Westmount

The erection of a residence, on Carleton Ave., for a client of H. A. Adams, architect, New Birks Bldg., has been postponed.

Tenders on the erection of a $15,000 residence, on Avenue Rd., for C. N. Robertson, 117 Notre Dame W., are invited by the architects, Hutchison, Wood & Miller, Royal Insurance Bldg.

Tenders for separate trades on the erection of a residence on Montrose Ave. are invited by the architects, Turner & Carless, 49 Beaver Hall Hill.

Ottawa, Ont.

The erection of a residence, at a cost of $6,500, is proposed by J. J. Gilchrist, 31 Centre.

W. J. Thomas, 34 Main St., proposes to erect a $6,000 residence on Pansy St.

The erection of 8 residences on Nelson St. is contemplated by D. Fraser, O'Connor St.

The erection of a tenement row on Newton St., at a cost of $7,500, is proposed by A. G. Marshall, 217 Booth Building.

W. W. Lister, 127 2nd Ave., has under consideration the erection of a residence on Clegg street.

The erection of a $50,000 residence on Craig St., is proposed by ... H. Lister, 127 2nd Ave.

Eugene Dagenais, of 163 McGillivray St., proposes to erect a residence at a cost of $5,500.

Regina, Sask.

It is understood that the Roman Catholic authorities have in mind the erection of 35 residences of 5 and 6 rooms each on Elphinstone and Princess Sts.

Toronto, Ont.

A permit has been issued to J. Thomson, 43 Victoria Street, for the erection of a detached residence on Goldwin Smith Avenue.

Plans have been drawn for the erection of two residences on Arundel Ave. for Frank Hewitt, 92 Chester Ave.

S. W. Graham, 862 College St., is about to erect a residence on Melgund Rd., at a cost of $7,000.

Geo. Bradley & Son, 100 Brooklyn Ave., invite tenders for carpentry, plumbing, hot water heating, plastering and painting on the erection of a residence in North Toronto.

W. S. Grimshaw, 462 College St., invites tenders on carpentry for several 2-family apartments. Owner supplies materials.

Winnipeg, Man.

A permit for the erection of a residence on McMillan Ave., at a cost of $5,000, has been granted to G. Fulljames 895 McMillan Ave.

Geuser Bros., 98 Lusted St., have been granted a permit for the erection of three residences on Wentworth St., at a cost of $15,000.

Windsor, Ont., Hall

Plans for the erection of a 2-family flat, at a cost of $5,500, have been drawn for Ferguson & Thomas, 31 Moy Ave., by Leybourne & Whitney, Sandwich St. E.

CONTRACTS AWARDED

Brantford, Ont.

The contract for the erection of a residence on Dufferin avenue, for Mrs. Robt. K. Duncan, has been secured by W. A. Noble, Inglewood Drive, Hamilton.

Hamilton, Ont.

The contract for masonry on the erection of an apartment on Park St. S. for J. A. C. Morrow, has been let to Smith Bros., 20 Norway. Other trades will be let shortly.

Montreal, Que.

The contract for addition to the residence of Robt. Reed, 698 Sherbrooke St. W., has been let to A. E. Wand, Victoria Bldg., Victoria Square.

Montreal West, Que.

The following sub-contracts have been awarded in connection with the erection of a residence on Brock Ave., for H. L. Trotter. General contractor and carpentry, J. J. Kirkpatrick, 5 Fenwick Ave.; steel, Dom. Bridge Co., Lachine; roofing, Hickey & Aubet, Dominion St.; plastering, A. Leger, 96 4th Ave., Ville St., Pierre; heating and plumbing, Mr. Bain, c/o general contractor.

Ottawa, Ont.

The following contracts have been awarded in connection with the erection **of a residence on Irving Street, for** J. J. Smith, Trust Bldg. Masonry, R. M. Saunders, 58 Lees Ave.; brick, Ben. Webb, 197 Gladstone. The carpentry will be done by day labor.

Sorel, Que.

The contract for the erection of flats on George St., for J. B. Guevremont, 144 Augusta St., has been secured by Gendron & Bernard.

Sarnia, Ont.

The contract for the erection of a residence on London Rd., for Dr. Sangster has been let to Robt. Irving, 321 Wellington St.

Toronto, Ont.

The contract for the erection of a detached residence on Hilton Ave., for A. McGee has been awarded to J. A. Kent, 54 Thomson St., Swansea.

Weyburn, Sask.

The contract for the erection of a residence for the Rev. Father Marard has been awarded to H. R. Ford.

Wolfville, N.S.

The contract for rebuilding the Acadia College Residence and Gymnasium has been let to the Rhodes Curry Company, of Amherst.

Power Plants, Electricity and Telephones

Assiniboia, Sask.

Tenders will be received by the Sec.-Treas. Assiniboia Rural Telephone Co., Ltd., C. M. W. Emery, Box 207, Assiniboia, until June 20th, for the supply of material and the erection of a telephone system. Plans and specications are at Dept. of Telephones, Regina.

Estevan, Sask.

Tenders will be received by the city secretary-treasurer, P. J. Stephens, until July 1st, for the supply and erection of two 250 kw. 2,300 volts, three-phase, 60-cycle, alternating current generators for direct connection to engine. Two exciters for direct connection to above generators. One 500 kw., 2,000 volts, three-phase, 60-cycle, alternating current generator for direct connection to engine. On exciter for direct connection to above generator. Three gas engines, using producer gas for above complete with all gas generators, tar and dust extractors and all the necessary gas and water piping, producers to use Estevan lignite coal, 8,000 B.T.U.'s. One switchboard, complete for above units. Particulars can be had from the engineer, S. G Dethridge.

Montreal, Que., Outremont

Tenders will be received by the town secretary-treasurer, E. T. Sampson, until 6 p.m. June 23rd, for (a) 20,000 ft. of rubber covered single conductor cable; (b) 1,500 nitrogen filled tungsten lamps; (c) six series tungsten regulators, transformers and switchboards. Specifications at office of the town engineer, Town Hall

(Continued on page 78)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned, and endorsed "Tender for Supplying Coal for the Dominion Buildings," will be received at this office until 4 p.m. on **Monday, July 6, 1914**, for the supply of coal for the Public Buildings throughout the Dominion.

Combined specifications and form of tender can be obtained on application at this office and from the caretakers of the different Dominion Buildings.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the contract. If the tender be not accepted the cheque will be returned.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 2, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—62371. 23-24

Sealed tenders addressed to the undersigned and endorsed "Tender for Quay Wall and Excavation at Victoria Harbour, B.C.," will be received at this office until 4 p.m. on **Monday, July 27, 1914**, for the construction of a Quay Wall and Excavation at Victoria Harbour, B.C.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers at Victoria, B.C.; New Westminster, B.C.; Confederation Life Building, Toronto, Ont., and Shaughnessy Building, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and and signed with their actual signatures, stating their occupations and places of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited of the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $25.00 made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,,
Ottawa, June 4, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—58389. 23-24

Tenders for Bridge

Tenders will be received by the undersigned till **Tuesday 30th inst.**, at 2 p.m., at Lamlash (at which time the tenders will be opened) for the erection of a steel bridge over a branch of the Saugeen River. Span 42 feet, roadway 16 ft. wide, with concrete floor. Also for two abutments for the same. Plans and specifications may be seen with James Warren, Engineer, Walkerton, or with the undersigned. A certified cheque for $100, payable to the Reeve of Township of Bentinck, must accompany each tender.

The lowest or any tender not necessarily accepted.

GEORGE BROWN, Reeve.

Lamlash, (R.R. No. 4 Elmwood)
June 3rd, 1914. 23-24

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, June 23rd, 1914**, for the construction of the following sewers, viz.:—

Battenburg Ave., Coxwell Ave. to 220 ft. East.
Bowmore Road, Wrenson Road to Gerrard St.
Canning Ave., Pape Ave. to Moscow Ave.
Central Ave., Indian Road to Indian Road Cres.
Chisholm Ave., Danforth Ave. to North City Limits.
Erie Street, Dundas Street to south end.
Gates Ave., w.s. Chisholm Ave. to Meagher Ave.
Geary Avenue, Dufferin Street to west end.
Gerrard St., Woodbine Ave. to Morton Road.
Harris Ave., w.s. Chisholm Ave. to Meagher Ave.
Hendrick Ave., 663 ft. south of St. Clair Ave. to south end.
Lane first north Danforth Ave., w.s. Pape Ave. to e.s. Carlaw Ave.
Lane first south Queen St., Gwynne Ave. to Elm Grove Ave.
Lane first north Queen St., Triller Ave. to Roncesvalles Ave.
Lane first west Shaw Street, Harbord Street to Lane first south Bloor Street.
Lane first north Wellington Street, Peter Street to Spadina Ave.
Lightbourne Ave., Geary Ave. to Brandon Ave.
Meagher Ave., Danforth Ave. to North City Limits.
Mercer Street, John Street to Peter Street.
New Market Ave., w.s. Chisholm Ave. to Meagher Ave.
Westlake Ave., Danforth Ave. to north city limits.
West Toronto Sewer System, Div. No. 2—Stand-by Tank.
Wrenson Road, Pullen Ave. to Bowmore Road.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, June 5th, 1914. 24

Under the Winding-Up Act

In Re

The

Star Iron Company Limited

Beauharnois, Que.

In liquidation

Sealed tenders will be received by the undersigned until **Thursday, June 25th, 1914**, at noon, for the purchase of the following assets:—

Foundry of 30 tons daily capacity, ready for operations comprising:—

Grounds, buildings, machinery, patterns, moulds, and plant, with rights in the water power and leases, situated at Beauharnois, P.Q., as per description to be furnished by the liquidator. The patterns and moulds comprise as follows: A.—the patterns and moulds for the celebrated "NEW STAR" boiler from No. 0 to No. 10, and all connections; B.—patterns and moulds for the "CANADA IMPROVED" radiators, 20 to 45 inches, plain and ornamental; C.—patterns and moulds for soil pipe and soil pipe fittings, in sizes 2, 3, 4 and 6 inches, in light, medium and extra heavy; D.—patterns and brass moulds for full assortment of the "STAR" steam fittings.

The tenders to be made for each lot separately.

A deposit of 10 per cent. shall accompany every tender. None of the tenders shall necessarily be accepted.

For all other information apply to

ALEXANDRE DESMARTEAU,
Liquidator,
No. 60 Notre Dame St. East,
Montreal, Que.

24

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Palmerston, Ontario," will be received at this office until 4 p.m. on **Tuesday, July 7, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., the Postmaster, Palmerston, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 13, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63099. 24-25

Bridge Tenders

Tenders, addressed to the undersigned will be received up to **Saturday, 10 a.m., the 27th inst.,** for the supply and construction of abutments and steel superstructure for a 40-ft. span over Horners Creek, Lot 17, Con. 17, between Townships of East Zorra and Blandford, in County of Oxford.

Plans and specifications can be seen at the Clerk's office in Court House.

N. E. BIRTCH,
County Clerk.
Woodstock, June 8, 1914. 24

Tenders for Cement Pavement

Tenders will be received by the Municipal Council of the Village of Cayuga addressed to the undersigned and marked "Pavement Tenders," up to **June 24, 1914**, for the followwing pavement construction in the Village of Cayuga. Plans and specifications may be seen at the office of Jackson & Kyd, Engineers, Dunnville, Ont.

The lowest or any tender not necessarily accepted. Tenders to be accompanied by a marked cheque for ten per cent. of the contract price as a guarantee of the performance of the contract.

Contract Number 1

King Street to Norton Street, Cayuga.
Excavation, 250 cu. yds.; tile drains, 1,500 lin. ft.; curb, 1,600 lin. ft.; pavement, 2,200 sq. yds.; catch basins, 4.

Contract Number 2

Ouse Street to Munsey Street, Cayuga.
Excavation, 420 cu. yds.; tile drains, 2,200 lin. ft.; curb, 2,248 lin. ft.; pavement, 3,300 sq. yds.; catch basins, 4.

J. W. SHEPPARD, Mun. Clerk,
24 Cayuga, Ont.

Department of Railways and Canals, Canada

Welland Canal

Stone Protection on Summit Level between Thorold and Port Colborne

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Stone Protection on Summit Level between Thorold and Port Colborne, Welland Canal," will be received at this office until 16 o'clock on **Friday, June 26th, 1914.**

Specifications and form of contract to be entered into can be seen at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, St. Catharines, Ont.

An accepted bank cheque for the sum of $1,500, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, June 8th, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it. 62751 24-25

Tenders

Sealed proposals for Bituminous Macadam Pavement, Concrete Sidewalks and Gutters and Crushed Stone or Gravel Macadam Streets, addressed to the Secretary-Treasurer, Richmond, P.Q., and endorsed "Proposals for Street Improvements," will be received by said Secretary at his office until eight o'clock p.m. of the sixth **day of July, 1914,** and at that time will be opened.

Specifications may be seen at the office of the undersigned.

E. F. CLEVELAND,
Secretary-Treasurer,
24 Richmond, Que

Notice to Contractors

Asphalt Pavements

Sealed tenders addressed to the Chairman and Members of the Board of Control, Ottawa, will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Thursday, June 25th, 1914,** for approximately 34,000 yards of asphalt, 1,100 yards of asphalt macadam, 15,300 lineal feet of concrete gutter and 6,300 lineal feet of concrete curb and gutter.

Any tender received after the above stated time will be declared informal.

Specifications and full particulars may be obtained on application to the City Engineer's office, City Hall, Ottawa.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.
Ottawa, June 13th, 1914. 24

Sealed tenders addressed to the undersigned, and endorsed "Tender for Revetment Wall at Burlington, Ont.," will be received at this office until 4 p.m. on **Monday, July 6, 1914,** for the construction of a Revetment Wall at the Town of Burlington, Halton County, Ont.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Burlington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, June 4, 1914

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 62561 23-24

To Contractors

DRAINAGE WORK. Tenders will be received by the undersigned up until 2 o'clock p.m. on **Tuesday, June 23rd,** for the construction and completion of Municipal Drains, Nos. 5 and 6 in the Township of Arthur. Plans and specifications may be seen at the office of the Township Clerk, Kenilworth, or at the Township Hall on the afternoon tenders are opened.

ALBERT HELLYER,
24 Kenilworth, P.O.

Tenders for Bridge Construction

[illegible] will be received at the office of the undersigned up to noon of **Monday, July 6th, 1914,** for the construction of a concrete truss bridge over the Don River between Con. I. and II. E. lot 25. Township of York, near Schmidt's Mill.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
[illegible] Engineer.
Toronto, June 16, 1914 24

Sealed tenders addressed to the undersigned, and endorsed "Tender for Bridge Substructure and Approaches at Hawkesbury, Ont.," will be received at this office until 4.00 p.m., on **Tuesday, July 14, 1914,** for the construction of Substructure and Approaches for an Interprovincial Highway Bridge across the Ottawa River at Hawkesbury, Prescott County, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Shaughnessy Building, Montreal, P.Q.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Hawkesbury Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE. Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, June [illegible], 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 62603 24-25

Gas Engine For Sale

[illegible] engine with magneto and battery, water [illegible] clutch pulley, 20 in [illegible] face. This engine is now [illegible] with natural gas, but can [illegible] at a very reasonable expense. Can be seen in operation at our plant. It has been used while our plant was under construction. Our power plant is now complete and we have no further use for this engine. [illegible] Leader Iron Works make and cost about $600 without duty or cost of installation. We offer now complete as it stands in our shop for $325 f.o.b. our plant. Partial pay [illegible]

[illegible] MUELLER MFG. CO., LTD.,
24-25 Sarnia, Ont.

Tenders
for
Bridge Construction

Sealed tenders, plainly marked as to contents, will be received up to noon of **Friday, June 26th, 1914**, by J. L. Jenkins, Esq., Clerk of King Township, Maple, Ont., and at the office of the undersigned, for the construction of a reinforced concrete beam bridge over the Cold Creek between lots 5 and 6, Con. XII., Township of King.

Plans and specifications may be seen at the office of J. L. Jenkins, Esq., Clerk of King Township, Maple, and at the office of the engineer, Frank Barber, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Engineer.
Toronto, June 16, 1914. 24

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, June 26th, 1914

for

Enlargement of Brown School
All Trades

Enlargement of Frankland School
All Trades

Enlargement of Morse Street School
All Trades

Midsummer Repairs
All Trades

Pupils Desks
Sundry Schools

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted. All tenders must be on revised forms.

W. C. WILKINSON,
Secretary-Treasurer.
J. W. JACKSON,
24 Chairman of Committee.

Tenders for Construction of Sewers and Sewage Disposal Works

Sealed tenders addressed to the Mayor of Whitby, Ont., will be received up to the **29th day of June**, not later than 6 p.m.

Contract No. 1.—Sewerage, comprising laying and jointing sewers, approximate quantity, 30 inch, 8,000 feet; 24 inch, 2,800 feet; 20 inch, 800 feet; 12 inch, 4,500 feet; 10 inch, 11,500 feet; 8 inch, 28,500 feet, together with the construction of manholes, etc.

Contract No. 2.—Constructing Sewage Disposal Works, comprising Tanks, Filters, Pumping Station, etc.

Plans, specifications and all necessary information may be seen at the office of the undersigned engineers.

The lowest or any tender not necessarily accepted.

J. E. WILLIS, Mayor.

T. AIRD MURRAY & T. LOWES,
Civil Engineers,
24 186 King Street West, Toronto, Ont.

AGENTS WANTED—A British firm manufacturing high class architectural bronze and steel work, including metal windows, gates and railing, door furniture, fanlight gearing, etc., want reliable agents in Eastern Canada and British Columbia. Apply Box 43, Contract Record, Toronto. 24

Wanted To Purchase

One second hand, stiff leg derrick, one ton capacity, with or without cables.

For Sale

One Ideal and one Singer cement block machines with pallets.

Apply F. W. HOARE,
24-25 St. Catharines, Ont.

Second Hand Contracting Plant For Sale

One 45-ton Marion Steam Shovel.
Two Canadian Rand Drills, one Overhead Cable Gear complete with Boiler and Engine, Trolley Cars and Quarry Skips (in use only a few months).
One Donkey Engine, Etc.
Prices and further particulars on application.

F. A. RONNAN & CO.,
23-24 Halifax, N.S.

Power Plants, Electricity and Telephones

(Continued from page 75)

Regina, Sask.
The superintendent of the Street Railway Department will call tenders shortly for the supply of material to build two flat freight cars. Brill 21 E truck, steel wheels, steel, etc., required.

Tavistock, Ont.
A by-law providing for the installation of the hydro-electric power has been carried by the ratepayers.

Winnipeg, Man., Fort Garry
A by-law providing for the installation of a distribution plant for electricity at a cost of $40,000 has been passed by the Rural Municipality of Fort Garry.

CONTRACTS AWARDED

Edmonton, Alta.
The city council has awarded to Escher, Wyss & Co., 20 St. Nicholas St., Montreal, a contract for the supply of one 6,000 kw. turbo generator, Zoelly impulse type.

Lake Megantic, Que.
The contract for the installation of the hydro-electric plant has been let by the municipal council to Messrs. Madden, of 821 St. Valier St., Quebec.

Port Arthur, Ont.
The city council has awarded to the Thunder Bay Contracting Company, 24 Water St. S., the contract for the erection of the power house.

Roleau, Sask.
The Crescent Rural Telephone Company, Limited, has awarded to Ross & Hayne, of Regina, the contract for the supply of material and construction of a telephone system.

Stratford, Ont.
The contract for the lighting of Ontario and Downie streets has been awarded by the city council to the Hydro-Electric Power Commission, Continental Life Building, Toronto.

Whitewood, Sask.
The Whitewood Rural Telephone Co. has awarded to the Northern Electric & Mfg. Company, 107 Kerr Block, Regina, the contract for material at $5,326, and to G. T. Brandon, the contract for the construction of a telephone system at $3,750.

Winnipeg, Man.
The Public Works Department has awarded to J. A. McTaggart & Co., Travellers Bldg., the contract for the construction of an induced draught plant for the new power house.

Business Notes

Lockwood, Sask.
The elevator of the Maple Leaf Elevator Company has been destroyed by fire. The loss is placed at $7,000.

Moncton, N.B.
Three stores and a residence belonging to the Misses McSweeney have been destroyed by fire; $10,000 loss. The premises will be rebuilt.

Montreal, Que.
A recent fire at the sash and door factory of Paul Beaudry, 637 Davidson St., resulted in a loss of about $60,000.

Powassan, Ont.
A serious fire here has resulted in the destruction of the Queen's Hotel and a number of stores and residences. The loss is estimated at $300,000.

MacLean Daily Reports are helping scores of progressive firms to a solution of the ever present and pressing problem of how to sell more at a reduced sales cost. They are to the business man what the compass is to the mariner.

Rates and samples on request.

MacLean Daily Reports, Ltd.
220 King St. West, Toronto

DENISON

Interlocking Hollow Tile

The Modern Building Material

¶ Sound Proof
Moisture Proof
Vermin Proof

¶ Thoroughly Bonded and Interlocked
Warm in Winter
Cool in Summer

¶ Inexpensive
Lays up Rapidly
Little Mortar Required

¶ Makes a Strong Wall
A Light Wall
A Hollow Wall

Write us for full data.

The One Price Company

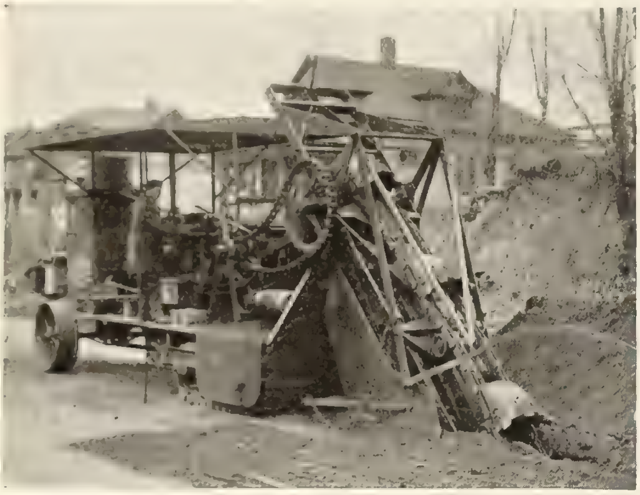
Sun Brick Company, Limited

Traders Bank Building, Toronto

One Company Dug 362,960 Feet, or 68.7 Miles of Trench in a Single Season with

Austin Trenching Machines

The average cost for all sizes of pipe for the entire season was 3.28 cents per foot.
These figures include all charges for labor, teams, supplies, repairs, freight and transportation.
Remember—these are **average costs.**



No. 00 Austin Trench Excavator at Sioux Falls, S. D., digging a sewer ditch nearly 13 ft. deep. Bringing up 28 in. boulders.

Thousands of feet of trench were dug by these same machines at a cost of as low as 1⅛ cents per foot.

If your trench work costs more than this you should investigate Austin Trenching Machines at once.

Whatever the digging you have—providing it is classed as earth excavation—an Austin Trencher will do it cheaper and do it better than it can be done in any other way. We have records similar to those quoted above which have been made on trench work throughout the world. These records are worth your knowing **now.**

Write to our Canadian Representatives—the one nearest you

Lecky and Collis, Limited,
Montreal, 49 Beaver Hall Hill.
Toronto, 43 Scott Street.
Napanee, P. O. Box 611.

Canadian Equipment & Supply Co., Calgary and Edmonton
E. G. Cullen, 418 Pacific Building, Vancouver

F. C. Austin Drainage Excavator Co.
Railway Exchange, Chicago, U. S. A.
Agents Wanted in Open Territory.

Old Houses Made New

In time the frost springs the clapboards apart and then your walls leak wind. Did you notice the heavy coal bill last winter? Instead of painting you should overcoat your home with cement plaster.

Herringbone Metal Lath

is ideal for the purpose. Merely nail it directly to your old siding and apply the plaster. It is perfectly self-furring.

Write for fuller information. Don't wait for another big coal bill.

Clarence W. Noble, ***General Sales Agent***
117 Home Life Building, TORONTO
The Metal Shingle & Siding Company, Manufacturers

A Highway Engineer Reduced His Hauling Costs

In the Engineering Record for December 6th, there is a very interesting article on "Highway Improvements in North Alabama," by P. S. Fitzgerald, highway engineer for Lawrence County, Alabama. We will repeat what Mr. Fitzgerald says about his hauling outfit:

"The haul here is in most cases short; 2 miles is the maximum. The Rumley, 'Oil Pull' tractor and

TROY

Reversible Wagons

on long hauls reduce the cost of hauling to about 10 cents per yard-mile compared with 25 to 35 cents per yard-mile with teams; although where three teams at $3.00 per day will haul all the stone crushed there is no economy in the tractor and reversibles. It costs little, however, to keep the hauling outfit in readiness, and its moral effect on the price of hired teams is very marked; for here as everywhere, team owners charge 'all the traffic will bear' —and generally strike for higher pay whenever the necessity for using them seems greatest.

The tractor used is small, pulling four 3-yard wagons and frequently has made 100 yard-miles daily at an expense of less than $10.00 besides spreading and leveling the crushed stone with an ordinary road machine or grader attached to the rear of the train. Good teams haul 1½ cu. yd. per load and if watched make ten to twelve round trips daily on a one-mile haul. The limit of a good day's work at macadamizing is the performance of the slowest machine from crushing to rolling. Thus far the county has found one mile in average weather a good month's work for one plant.

If you have any kind of a hauling job now, or think you may have some day, you ought to have our Hauling Book 2R. It tells why and how more than 250 different Troy Trains of Reversibles (a few of which are illustrated here) have each more than cut their owner's hauling costs in half. It discusses fully and frankly the hauling question. We'll be glad to send it to you.

The Troy Wagon Works Co.

N. Market St. TROY, OHIO

DISTRIBUTORS:

[illegible]
[illegible]
[illegible]
H. H. Hoover & Company, Pittsburgh
[illegible]
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"NO SIR: IF YOU WANT MY FACE BRICK YOU MUST TAKE MY INSIDERS AS WELL."

Have you been told this?

What better evidence in favor of

SAND AND LIME BRICK

The brick that can stand alone on its merits. A Good Brick. A True Brick. A Whole Brick.

The brick that sells itself.

Why buy an inferior brick that has to be forced upon you against your will?

Our April shipments were 300,000 weekly. Are they going on your job?

Look for the YSB stock mark.

York Sandstone Brick Co.
TORONTO Limited

OFFICE: 123 Bay St.,
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Phone Adelaide 2023

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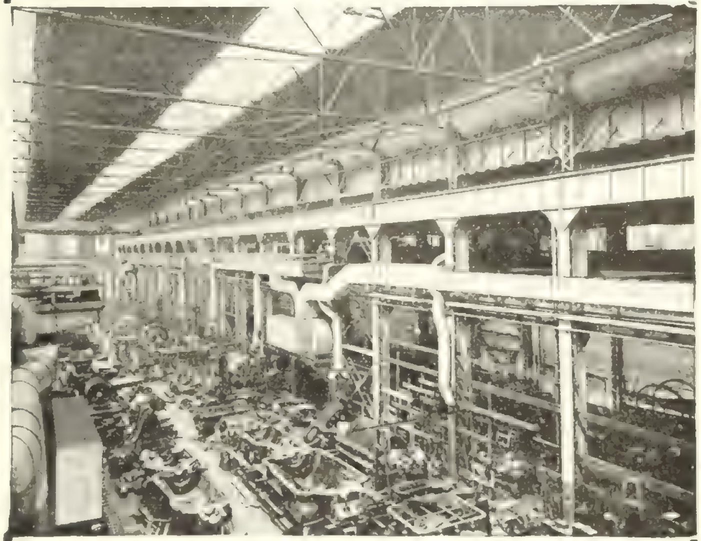

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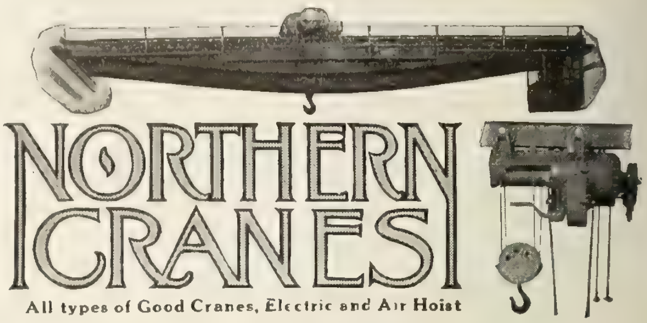

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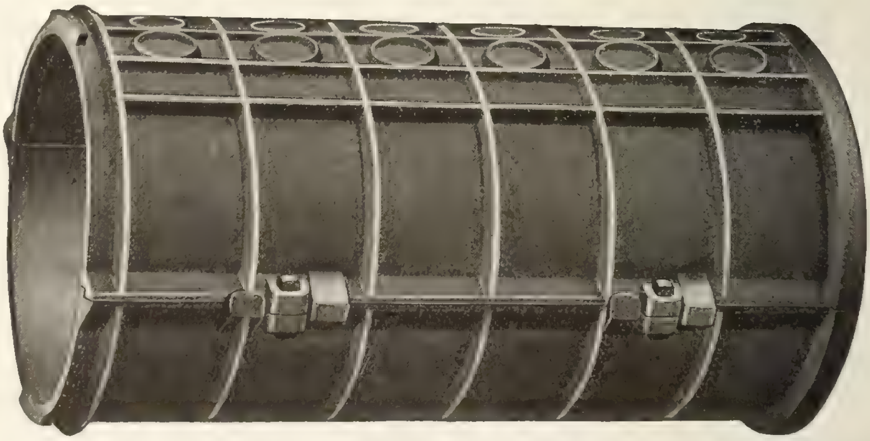

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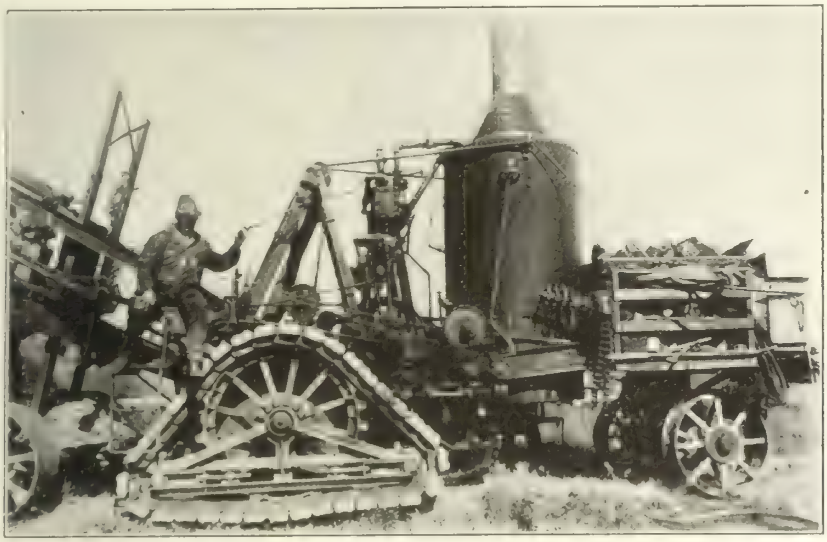

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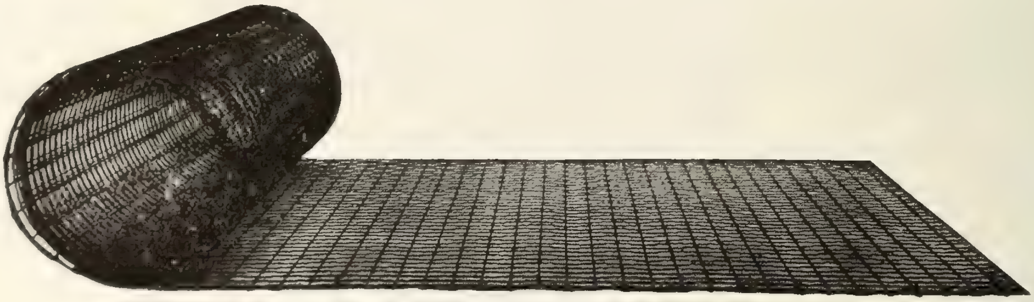

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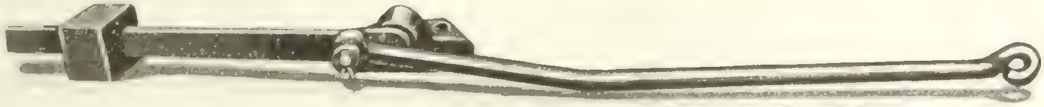

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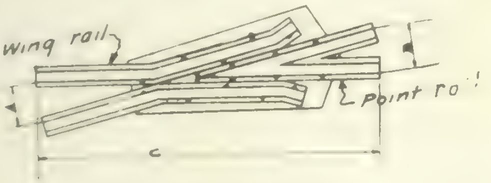

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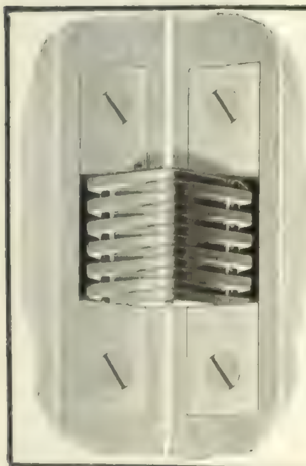
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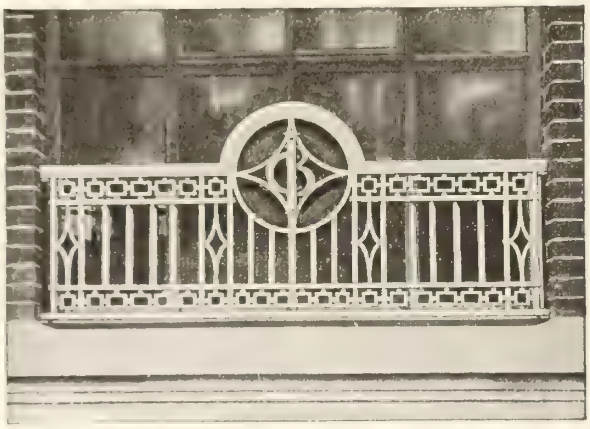

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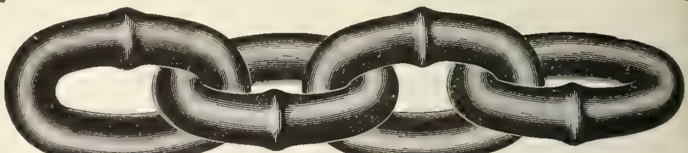

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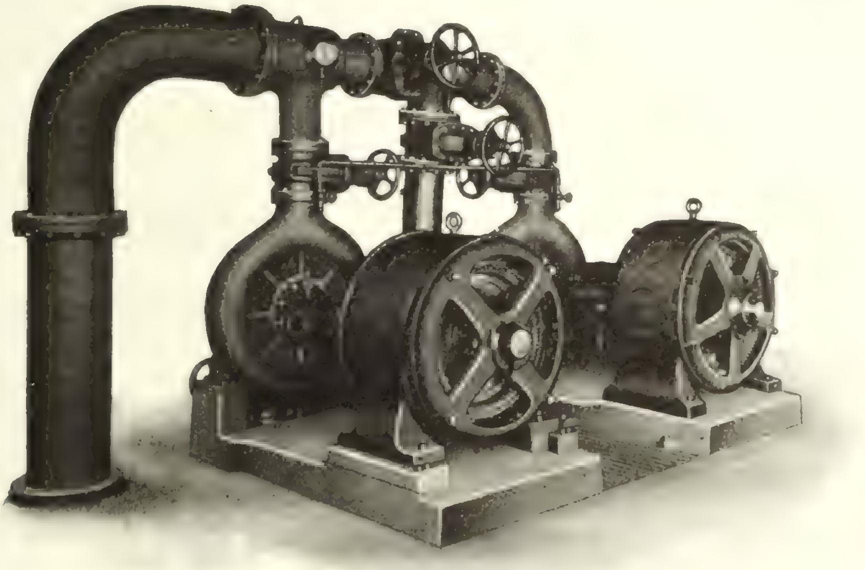

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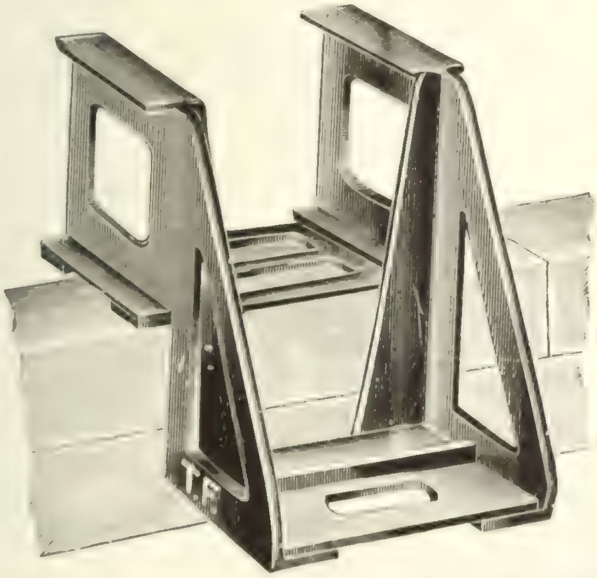

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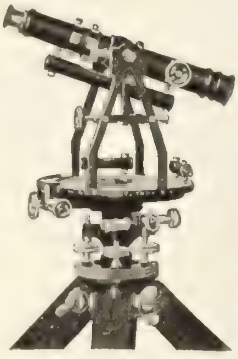
BUILDERS TRANSIT or
ARCHITECTS LEVEL

to establish his lines and grades quickly and accurately.

Write for booklet illustrating and describing the use and adjustment of these efficient, practical instruments, which are guaranteed to give satisfaction. Their moderate cost will surprise you.



No. 105
Builders Transit

W. & L. E. Gurley, Troy, N.Y.

Makers of Good Instruments since 1845
Branch Factory: Seattle, Wash.

Builders' Supplies

- Lime
- Portland Cement
- White Cement
- Keenes Cement
- Plaster Paris
- Hard Wall Plaster
- Mortar Colors
- Fire Brick
- Sewer Pipe
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- Sacketts Plaster Board
- Parkers Corner Bead
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With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

Ontario Lime Company
Limited
Crown Office Building, Toronto, Ont.
Head Office Phones: Main 5472—5473

" Big-an-Little "
MIXERS

The Best Batch Mixer For the Least Money

The intrinsic value of a concrete mixer lies in the net profit it brings to the owner after deducting initial cost and operating and upkeep expenses. The Big-an-Little mixer is one of the cheapest on the market. In actual use it pays for itself at least twelve times over in the course of a year.

The operating cost of the "Big-an-Little" mixer has been reduced to a minimum—three cents an hour. As for repairing expenses, we will guarantee your ledger free from items of this nature with "Big-an-Little" mixers on the job. You want a mixer. Write us for booklet and prices.

" A Mix a Minute "

Jaeger Machine Co., Columbus, Ohio

Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs.

Careful attention to details and thorough workmanship have made Meadows' stair work popular.

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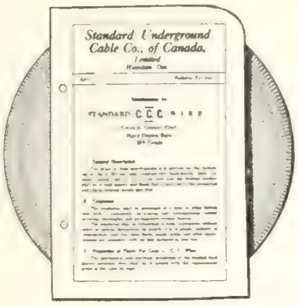
The GEO. B. MEADOWS

Toronto Wire, Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.



This New Bulletin

has been published for your information and should be in your files. It gives complete information regarding the properties and characteristics of 30 per cent

Colonial Copper Clad Wire

TRADE **C.C.C.** MARK

If you are interested in copper clad wire for bond wires, bare wires or strands, rubber insulated or weatherproof wires, *write our nearest office for C.C.C. Specification Bulletin.*

Standard Underground Cable Co. of Canada, Limited
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Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories.

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It is easy to obtain with our plants and apparatus

We design and contract for complete municipal filtration plants of any capacity.

We supply and install apparatus for sterilizing water supplies by the application of calcium hypochlorite.

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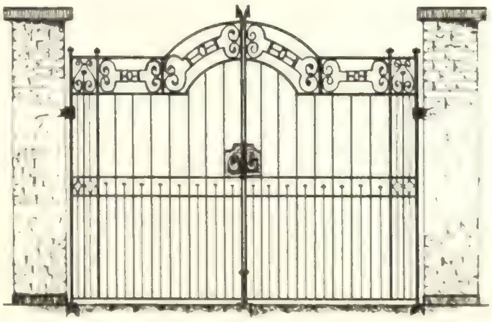
We have no affiliations or working acquirements with any of our competitors.



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Iron Stairs — Fire Escapes
Door Grilles — Wire Work

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and Ornamental Glass

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Roof Trusses — Turntables
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of all kinds

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ATWOOD

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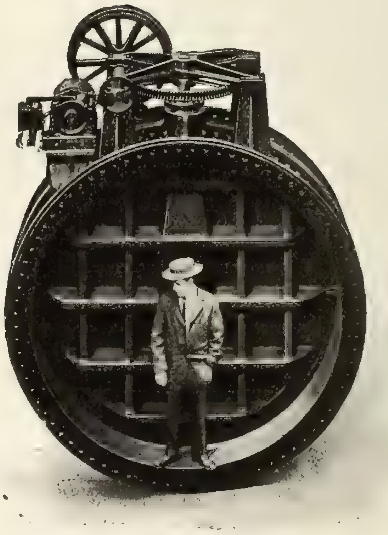

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We make a specialty of designing and executing complete piping contracts. Estimates furnished on receipt of plans and specifications.

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Manufacturers

Flexible and Flange Pipe,
Special Castings and all kinds
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3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

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Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

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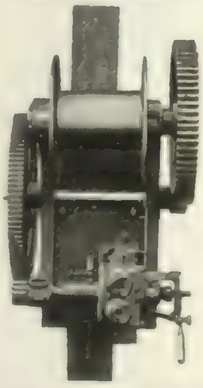
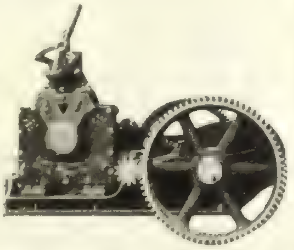


HOISTING ENGINES
STEAM CRANE HOISTS
MOTOR CRABS
SWINGING ENGINES

Write for catalog and prices

Dake Engine Co.
Grand Haven, Mich.

Montreal Agents:
Mussens Ltd.



We are now in a position to offer

"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

The Queenston Quarry Co., Ltd.
ST. DAVIDS, ONT.

Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

HUMBER BRICK YARDS
Lime, Sewer Pipe and Fire Brick

JOHN MALONEY
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"Galvaduct" and "Loricated"

Conduits

for Interior Construction

Conduits Company, Limited
Sole Manufacturers under Canadian and U. S. Letters Patent
Toronto - Canada

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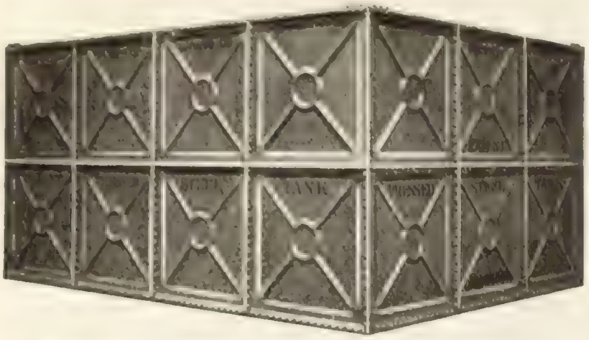
NATIONAL IRON WORKS, Limited

LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, **Carried in Stock**

Lake or Rail Shipments   **Offices, Works and Docks, TORONTO**



Made in any length or width in multiples of 4-ft. by 8-ft. or 12-ft. deep.

Patent Pressed Steel Tanks

are built up of plates 4 ft. square by 5/16th in. thick. There are only three types of plates and all are interchangeable. Easily erected by unskilled labor.

LIGHT STRONG CHEAP UNBREAKABLE. IMMEDIATE DELIVERY FROM STOCK.

STEEL PIPES—Welded or Rivetted

of any diameter over 12 inches and having any desired type of joint.

Thomas Piggott & Co., Ltd.
BIRMINGHAM
Cable Address "ATLAS BIRMINGHAM"

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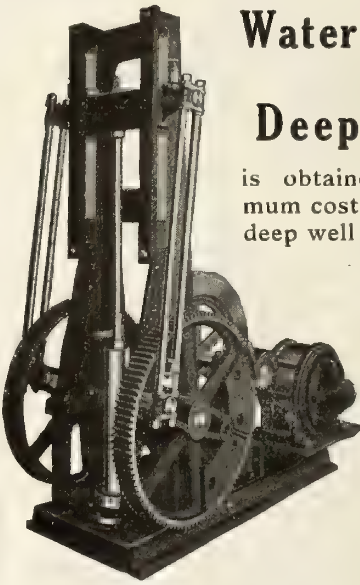
is shown by Architects specifying

Dark Hollow Gray Bedford Stone

Blocks Sawed
Planed Turned

The Consolidated Stone Company
BEDFORD, Ind.



Water Supply from Deep Wells

is obtained at a minimum cost by use of our deep well pumps.

Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer

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Lawrenceburg, Indiana, U. S. A.

Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

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"Bull Frog" Wheelbarrows—Scrapers and Concrete Carts

are strictly high grade. Are built to meet all requirements of the building trade.
The price is exceedingly low considering the quality.

THE LONDON CONCRETE MACHINERY CO.
of London, Ont., are the sole distributors for Canada. They carry a stock in their many branch ware-houses and agencies. *Write them* for *catalogue and quotations* at the nearest ware-house.

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Neptune Meter Co.

Manufacturers of the well-known

TRIDENT Frost-Proof Water Meters

Write for Catalogue

Main Office - 90 West Street

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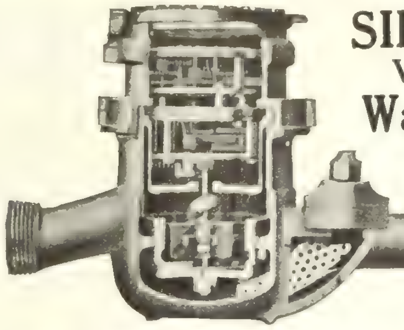

SIEMEN S
Vane Wheel Water Meters

Dry Running Type

The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

Literature on request.

Siemens Company of Canada
LIMITED

Head Office: Transportation Building

Toronto MONTREAL Winnipeg

MEXICAN EAGLE ASPHALT

TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
2—Water will not readily injure it.
3—Exposure to sun and air will not cause its deterioration.
4—It has great cohesive strength.
5—It is more ductile and flexible than other asphalts.
6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

Sole Canadian Agents for the Mexican Eagle Oil Co. Limited

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Electric Steel Castings

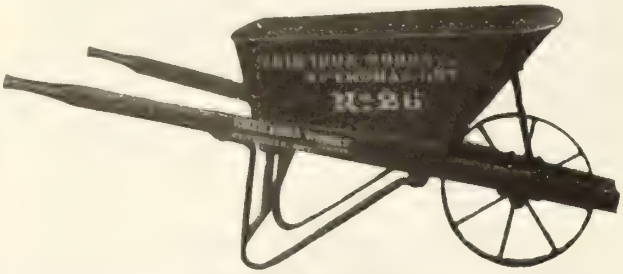
Our Welland plant will be ready to furnish ***Carbon, Manganese, Alloy Steel Castings*** and ***Forging Ingots,*** by the end of May, made by the Electric Furnace process.

This process makes a dependable high grade steel and steel casting, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars

The Electric Steel & Metals Co., Ltd.

Welland, Ontario



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Concrete Wheelbarrow

THIS barrow specially suited to handling concrete. The tray is welded steel without rivets and is absolutely watertight.

The legs are made of channel iron and thoroughly braced.

The wheel is guarded and the barrow may be dumped forward or at sides.

Write us for prices.

The Erie Iron Works, Limited

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Standard White Lime Co.

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Manufacturers of high calcium and magnesia lime.

Works at Guelph, Brockville and St. Marys.

We make a specialty of

Hydrated Lime

You always have fresh lime when you use Hydrate

Head Office - GUELPH

Write us for further information

Canadian Supply & Contracting Co., Limited

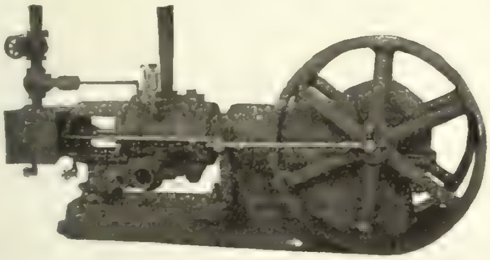
Structural Waterproofing, Engineers and Contractors

TORONTO, CANADA

Let Us Tender on Your Roofing, Waterproofing and Flooring Specifications

We supply ROOFING, WATERPROOFING and INSULATING MATERIALS, and undertake contracts for Roofing, Waterproofing, Tar Rock, and Mastic Asphalt Flooring. Our Complete Equipment enables us to execute the work in accordance with Architect's and Engineer's Specifications.

Our work on many notable Canadian Buildings is a guarantee of our ability to successfully carry out the most important contracts.



INDIVIDUALITY

Would it not be well to acquaint yourself with the individuality of the air compressor you are going to buy before making a definite selection?

You would naturally do this when selecting a person for a responsible position. Is it not just as important when selecting a machine for an equally responsible position?

When you consider that often both the quality and quantity of your output depend largely if not almost wholly, on your compressor, you must realize that it should possess a marked individuality and unfailing reliability.

The experience of nearly half a century in building compressors for every conceivable purpose; the refinement resulting from this wide and varied experience; the development in the use of special metals and treatment thereof are reflected in the individuality of Ingersoll-Rand Compressors.

The correct proportioning of ports and passages; the use of superior valves; the reduction of losses through slippage of air past valves and other moving parts; the use of adequate and proper cooling systems; the correct proportioning of cylinders to properly distribute the work done and the careful workmanship characterizing important parts of Ingersoll-Rand Compressors, all guarantee the maximum delivery of compressed air with the minimum of power.

Then, too, the selection and use of special alloy metals, strengthened, toughened and hardened by elaborate processes to increase life and wear; the liberal proportioning of bearings; the enclosed dust-proof automatic flood oiling systems and many other related features, minimize wear, repairs and upkeep costs. They increase the value of Ingersoll-Rand Compressors to their users and give them the rating of air compressor aristocracy.

Efficient, reliable, self-control devices are of a distinctly superior character in Ingersoll-Rand machines and automatically proportion work done to compressed air requirements. Here, too, the individuality of Ingersoll-Rand compressors stands out and minimizes the element of attendance.

CANADIAN INGERSOLL-RAND CO.
LIMITED
COMMERCIAL UNION BUILDING, - MONTREAL, CAN.
WORKS: SHERBROOKE, QUE

Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Lethbridge, Nelson, Vancouver.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl., car lots, $1.55. Pkgs extra.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red and buff brick, $18; common red stock brick, $13 to $15; grey, $11.50 to $12; wire-cut brick for foundation work, $11; No. 1 enamelled brick, all colors, from $80 to $150; tapestry brick, $23 to $32; sand-lime brick, $8.60; King Edward siding, $7.50 at the yard; $10.50 delivered on the ob. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M., f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18. Brick 2½ x 4 x 8½ in., blocks 3½ x 4 x 8½ in.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.30 per ton.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel.—$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 8 to 12 in. wide (rough) $26 to $30; 2 in. white pine, bill stock, $28 to $34; 7/8 by 8 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $28; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $3.25; 10 in. pine base $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. clear shingles $3; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 60 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

Raw linseed oil—in bbls., 65s per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 65c.

MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.90 car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—$1 per ton, car loads, on cars.

Gravel—$1.35, f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1 in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. Copper bearing sheets—flat, Apollo keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—British Manilla, 15c basis per pound; second grade, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

Winnipeg Prices

LUMBER (BUILDING MATERIALS)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in carload lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.80 per cu. yd.

Gravel—Per yd., delivered, $1.90.

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

Paints and Oils—White lead, ground in oil, $8.80 per 100 lbs.; boiled liseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.80 per bbl.; putty in 25-lb. tins, $3.20; turpentine, in bbls., 80 cents per gal.

(Continued on page 106)

RAILS BILLETS

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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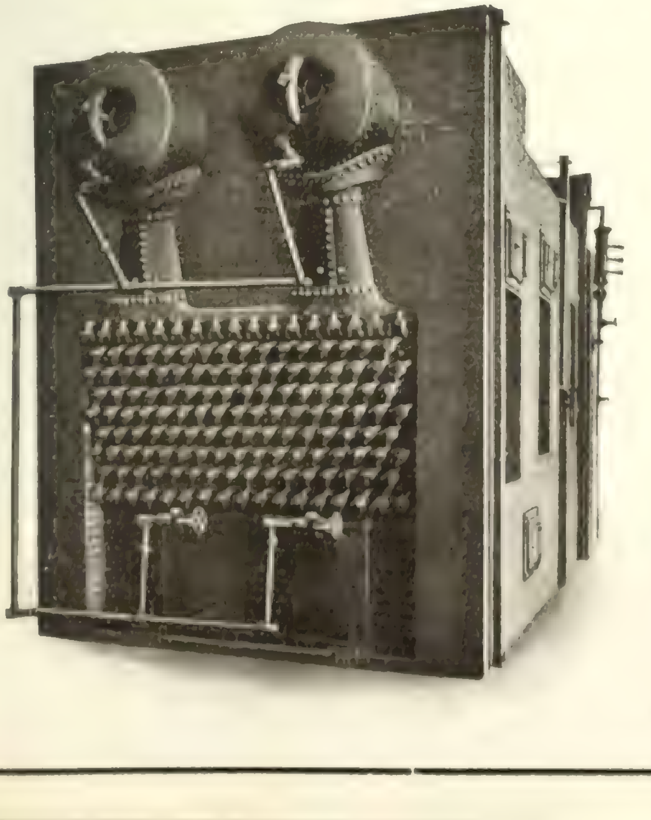

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HALIFAX, and in the King Edward Hotel TORONTO

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

TRADE CONDITIONS AT VANCOUVER

[illegible] operations in the Vancouver [illegible] as active during May as had been anticipated and in consequence the demand for most classes of building and engineering materials, particularly at the close of the month, was a trifle disappointing. The only outstanding evidences of building activity in this vicinity at the present time are to be found in the Point Grey district, where a considerable number of good-sized dwelling houses are in course of erection and many others are in contemplation. In the city itself, though the volume of construction projected for the summer months is fairly encouraging, there is apparently insufficient work in view to warrant the promise of anything better than a moderate call for most classes of materials during the present season. Enquiry for paints and oils during the last few weeks has been most satisfactory and the prospects for June are reported reasonably bright. In the crushed stone, sand and gravel market business is reported quiet with the outlook somewhat uncertain. The same can also be said of the steel and iron market. Cement, lime, brick and similar supplies are moving only in moderate volume, but local demand for lumber appears to have picked up to some extent with, however, no immediate prospect of an improvement in prices. An advance of five cents in boiled linseed oil and raw linseed oil comprises the only change in prices since last month's review.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.25; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SUNDRIES AND SPECIALTIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls., 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

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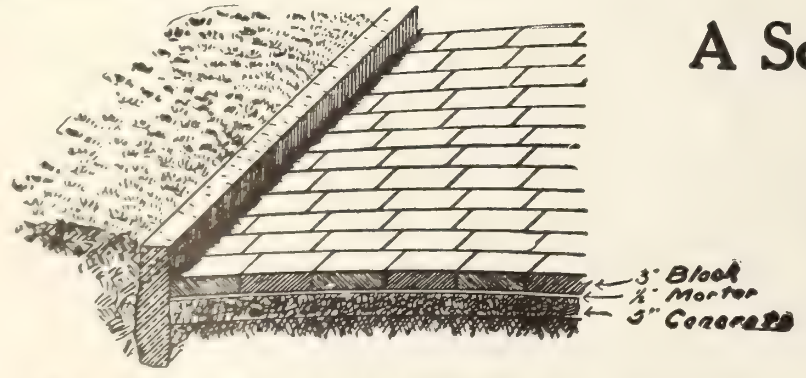

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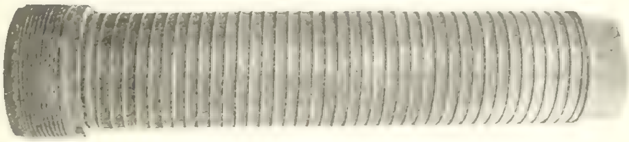

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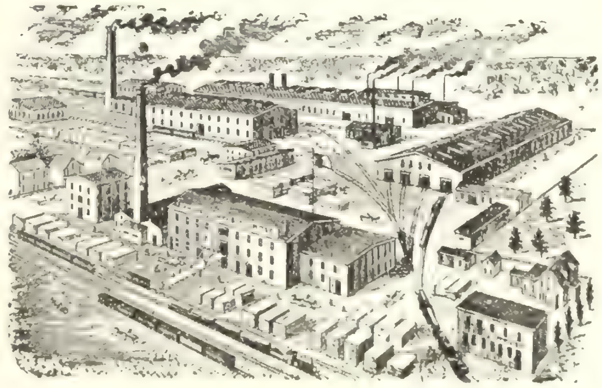

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ESTABLISHED 1886

Contract Record and Engineering Review

220 King Street West, Toronto

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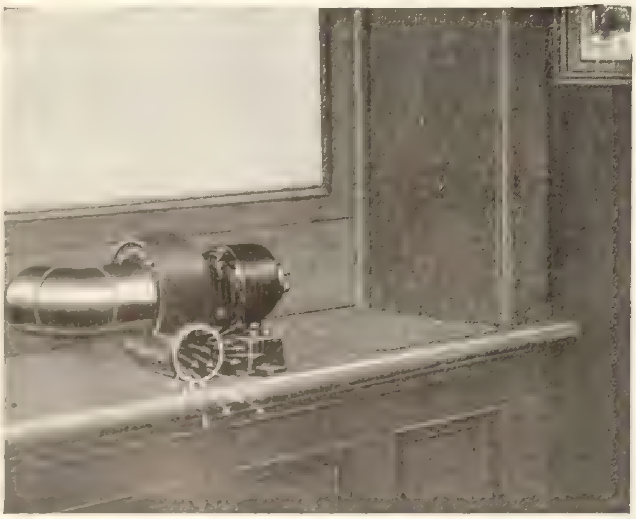

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Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow, Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00

The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons, 102 pages. Illustrated. Price 50c.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited, London. 618 pages, well illustrated. Price $2.00.

A Treatise on the Inspection of Concrete Construction, by Jerome Cochran, C.E. Published by Myron C. Clark Publishing Company. 594 pages. Price $3.00.

Foundations of Bridges and Buildings, by Jacoby and Davis. Published in 1914 by McGraw-Hill Book Company. 602 pages. Illustrated. Price $5.00.

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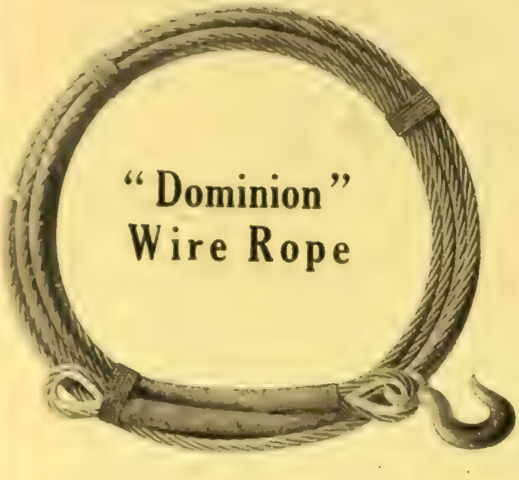

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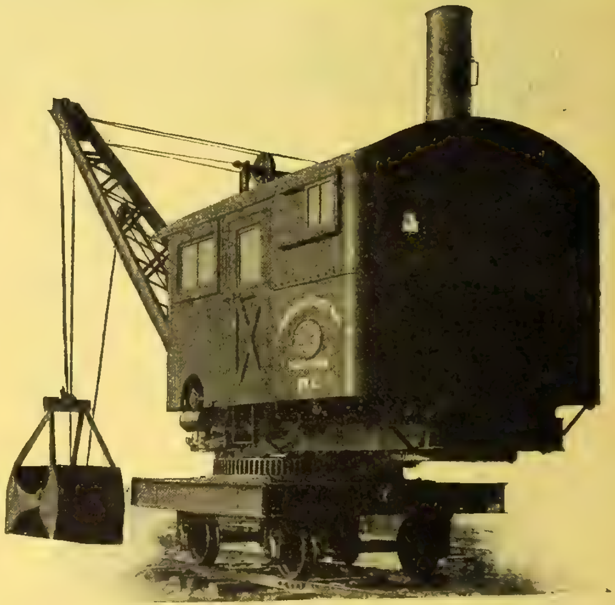

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Vol. 28 Toronto, June 24, 1914 No. 25

Contract Record and Engineering Review

ESTABLISHED 1886

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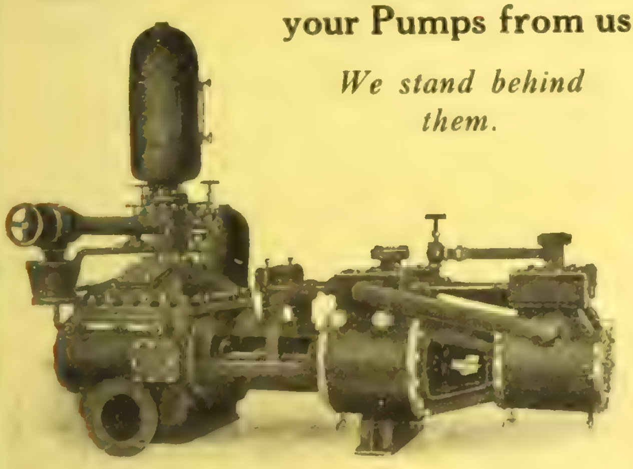

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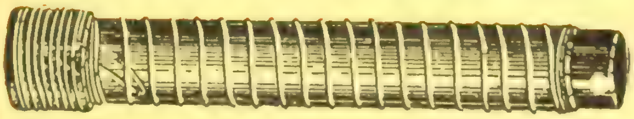
MONTREAL, CAN.



Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One half the cost of Iron Pipe and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
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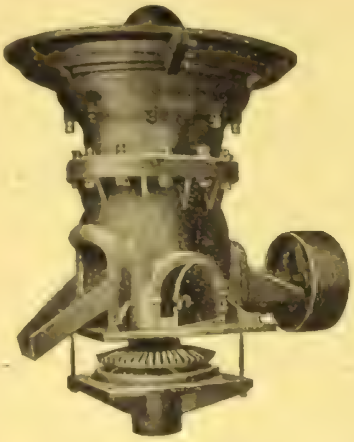
Full Particulars and Estimates Furnished



"Announcement"

In addition to a full line of other types of crushing machinery and equipment we are now building

Gyratory Crushers

of most modern design and equipped with an improved

Water Cooled Eccentric Bearing

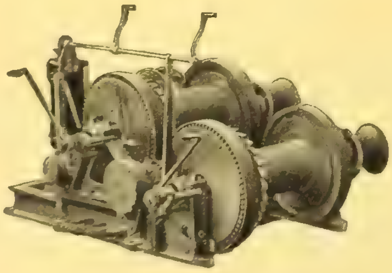
Made in all sizes for all capacities and for crushing any kind of material.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catherines Toronto Montreal Cobalt South Porcupine
Vancouver and Nelson

"American" Electric Hoists



do electrically the same high-grade work "American" Engines do by steam. They have the regular "American" Frictions; powerful, easy to operate, cool running—can be adjusted to offset wear.

There is an "American" Electric Hoist to meet every hoisting requirement—heavy or light, fast or slow. They are made with from one to three drums. Load is under absolute control at all times and can be locked at any point.

Motors are heavy type, variable speed and are capable of taking large overloads for short periods. The "American" Roller Ratchet prevents the load from dropping should the current suddenly fail.

American Hoist & Derrick Co
St Paul Minn.

Sold by General Supply Co. of Canada, Ltd., Montreal. Ottawa, Toronto.
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Grand Avenue Viaduct, Milwaukee, Wis. Monolithic Concrete Construction, Spans—8 of 145 ft. each. Length, 2088 ft. Width 67 ft. Height 80 ft.

Concrete Bridges

Artistic - Economical - Durable

The important requirements of any material for bridge construction are fully and economically met by concrete.

Concrete may be molded into any form, therefore, is particularly adaptable to bridges necessitating special construction. Its great strength, economy and permanence combined with its almost unlimited possibilities in obtaining artistic effects, gives concrete a preference not attained in any other material.

The strength of concrete increases with age, which gives it great reserve strength and reliability. Its durability is best evidenced by structures that have been in use in different parts of the world for periods extending over a great number of years.

The weight of a concrete bridge is so large in comparison with the live loads to be supported, that vibration and deflection are almost imperceptible. The use of concrete for bridges not only means economy and convenience to the Engineer and Contractor, but permits practically all of the cost to be returned to the ratepayers for cement, sand, stone or gravel, lumber, teams, and labor.

The total cost of a bridge can only be determined by adding to the first cost, the cost of maintenance during the life of the bridge. Concrete requires a minimum upkeep, thus making the first cost practically the only cost.

We have complete information about concrete bridges of all sizes, including details as to location, cost, engineers, contractors, etc. This information may be had for the asking. Address

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884 Herald Building, Montreal

BIG OPPORTUNITY

For the Paving Contractor

The

CHICAGO STREET PAVER

Will cover a 40 foot street without any difficulty.

Equipped with:

Two-way Traction Drive and Compensation Gears.

Rear Discharge.

A wide loading skip, (will accomodate three wheelbarrows at a whack.)

Handles three batches—one in the skip, one in the drum and one in the distributor.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
HALIFAX, 78 Granville St.

The

CHICAGO STREET PAVER

Combines the Four Esssentials of the successful Paving Machine

Batch Mix
Continuous Discharge
Automatic Distribution
Traction Drive

RAPID CHARGING

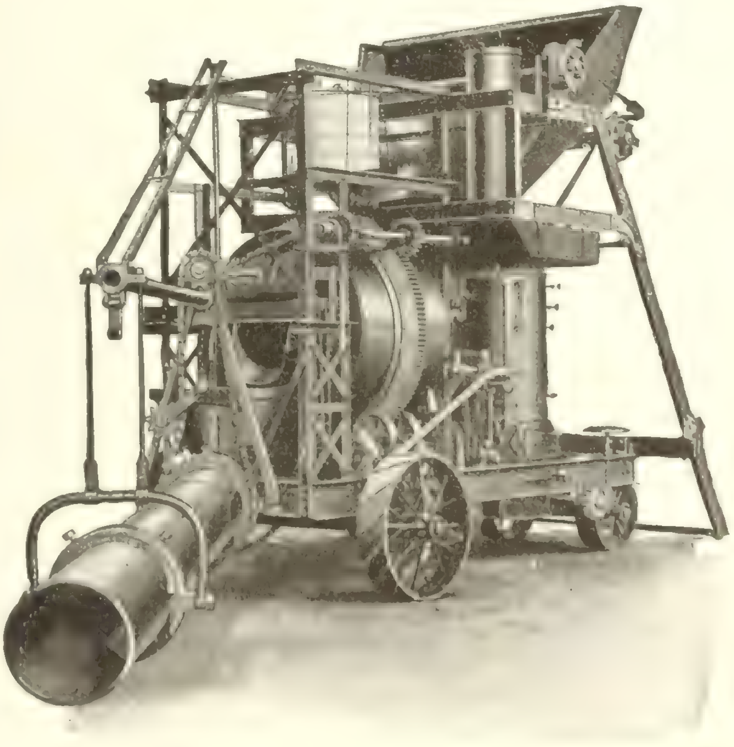
The Skip is a low-backed, shallow pan, as wide as the truck itself. Three wheelbarrows can be dumped into the No. 14 skip at the same second.

BIG OUTPUT

The mixing goes on right up to the instant the concrete is discharged on the street. The rotary distributor MIXES while it distributes; making it easy to turn out enormous yardage without sacrifice of quality.

AUTOMATIC DISTRIBUTION

The revolving pipe swings across the street, placing the mixed material exactly where needed. It is always mixing.



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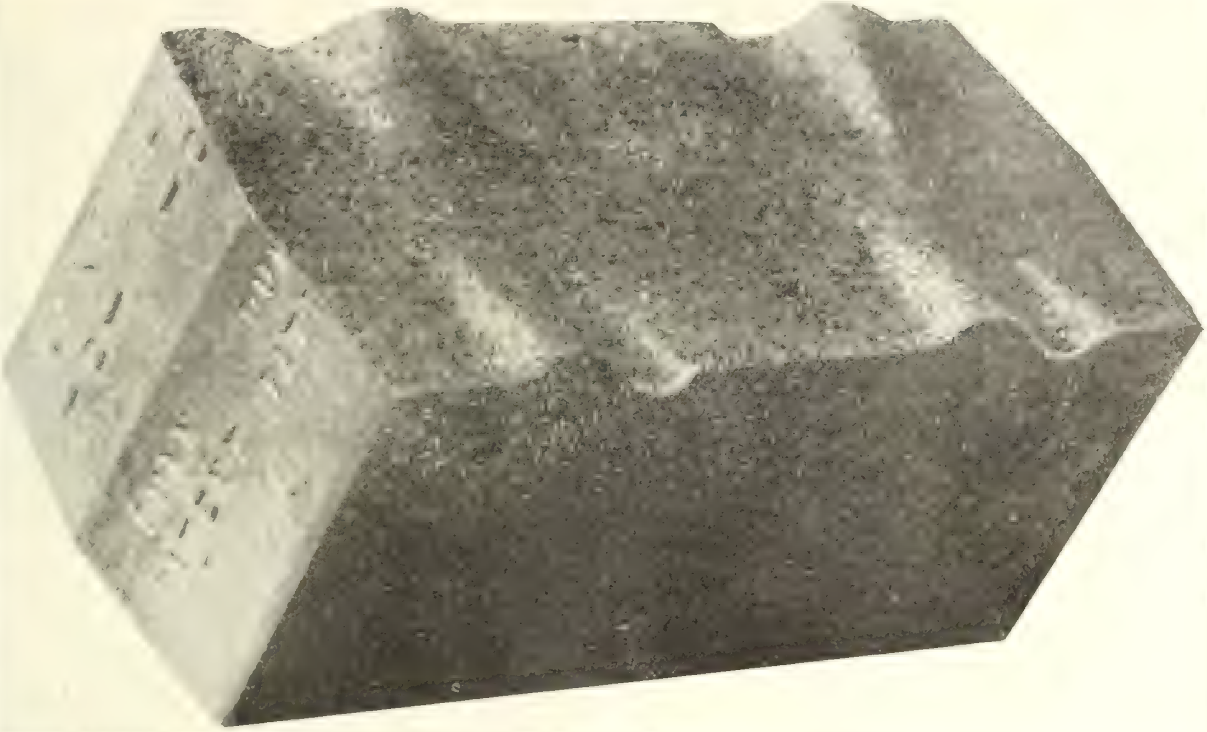


Observe the Wire-Cut-Lugs

THIS is a photographic reproduction of a Bessemer Wire-Cut-Lug Block. Note the Dunn patented lugs, the evenness of the wire cutting and the smooth, wearing surface—four inches of tough, durable, hard wearing surface.

BESSEMER WIRE-CUT-LUG BLOCK

Patented lugs allow cement grouting to flow easily between the block and thus make a perfect, lasting union. The ideal road paving for motor-trucks, heavy wagons and automobiles. Lowest traction resistance. Easily kept clean. Low maintenance cost. High quality that never varies—always uniform, reliable and safe. Bessemer Paving Block outlast all other material, and forms easily the cheapest paving when efficiency and length of service are considered.

Every carload factory-tested. For a permanent, durable, always-satisfactory road specify Bessemer Wire-Cut-Lug Block.

Send for free illustrated catalogue. Full of interesting facts and information.

Bessemer Limestone Company

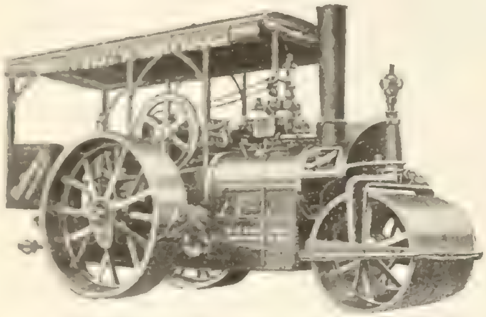
Youngstown, Ohio

Canadian Agents. G. W. ESSERY, 47 Yonge Street, Arcade Building, Toronto, Ontario
STINSON-REEB BUILDERS SUPPLY CO. Montreal, Quebec.

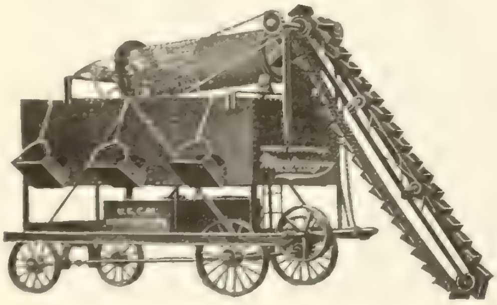
General Car and Machinery Works, Limited

Quebec MONTMAGNY, P.Q., Can. Montreal

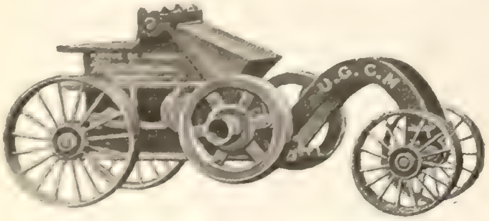
Head Office and Works



"Montmagny" Steam Road Roller.



"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny" Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"

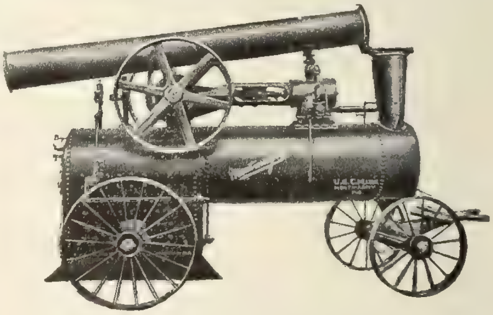
The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

For crushing field stone, granite, etc., "Montmagny" jaws are made of manganese steel. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.

"Montmagny" Road Sprinkler.

The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.

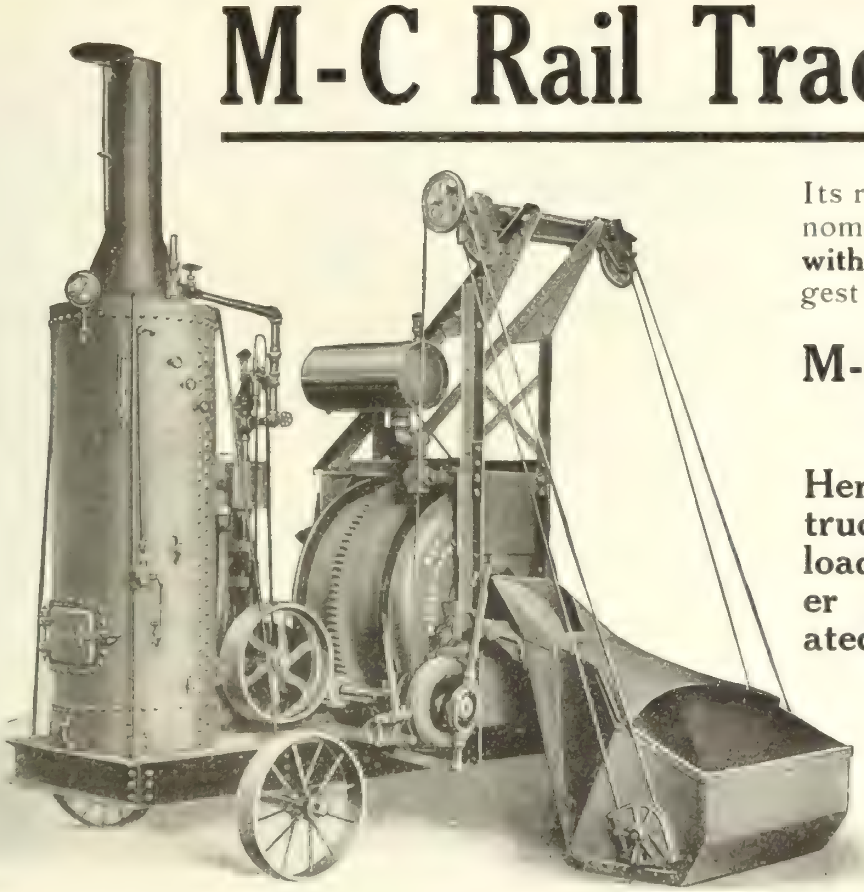


"Montmagny" Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.

"Montmagny" Manganese Steel Jaw Plates

M-C Rail Track Mixer



Its reputation for lasting, economical service—**"most mixing with least fixing"**—is the biggest thing to remember about the

M-C RAIL-TRACK MIXER

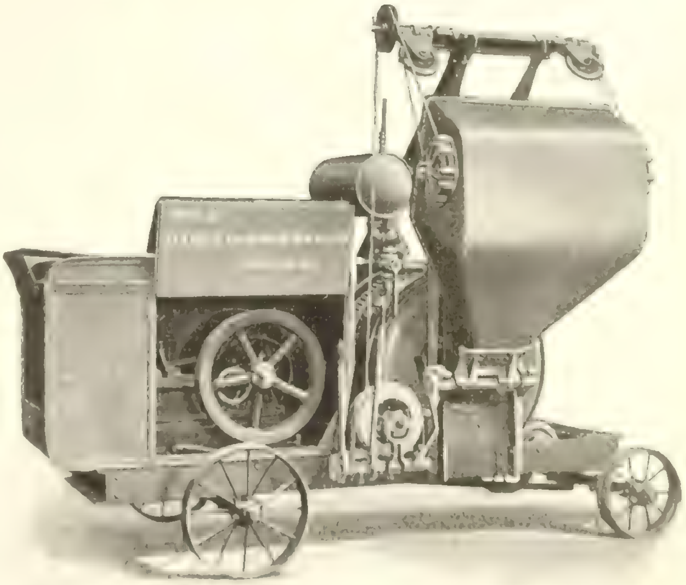
Here it is—mounted on trucks, with elevating side loader and automatic water measuring tank; operated by steam engine.

The all-steel rail tracks around the drum, the segmental drum gear, the roller-bearing wheels of chilled semi-steel, the semi-steel drum of great strength and toughness, the heavy steel channel frame, the M-C friction clutch are some of the construction features of this machine which will end your mixer troubles.

The two illustrations show you M-C Rail-Track Mixers operated by steam and gasoline power.

This mixer is built in five sizes, with capacities of ¼, ⅓, ½, ¾ and 1 cu. yard of concrete per batch.

Capacity 6 to 27 cu. ft. of mixed concrete, or 9 to 40 cu. ft. of loose material per batch.



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CANADIAN FAIRBANKS-MORSE CO., Ltd.

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company

465 Old Colony Bldg., CHICAGO

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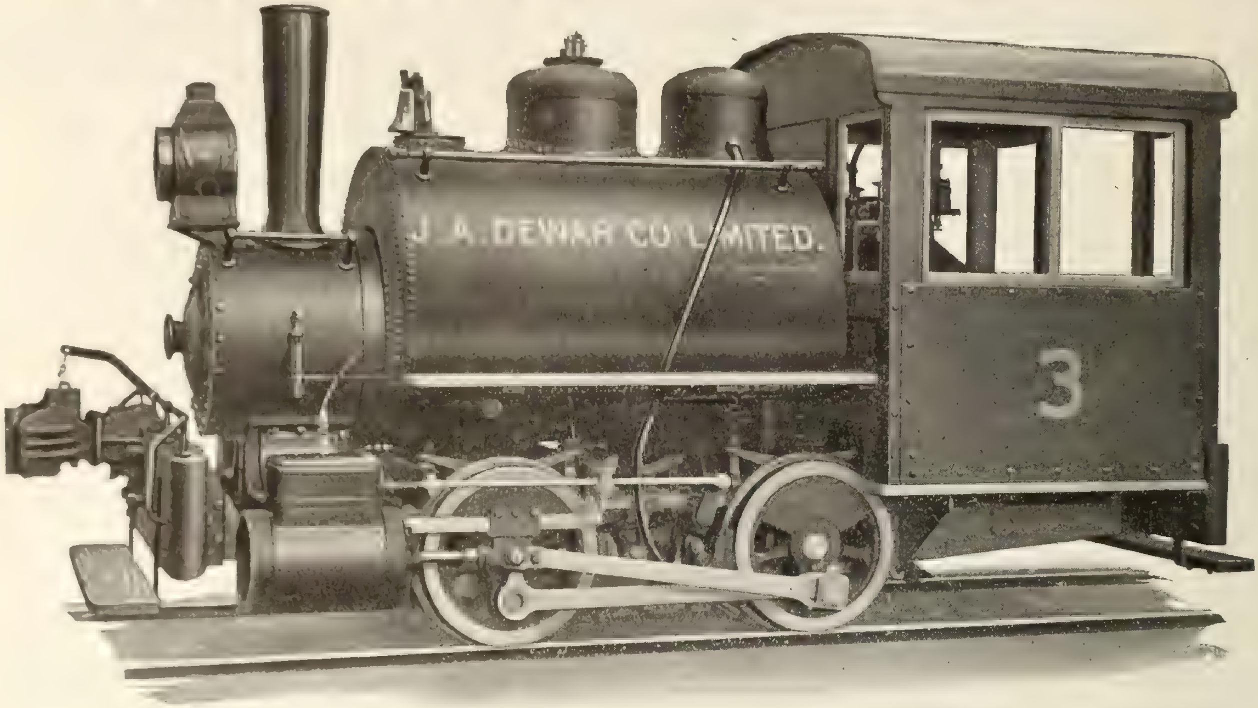

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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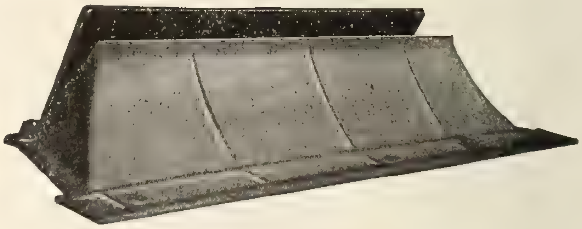
10 % Off

"COVERT IMPROVED" DAMPER



Owing to the increased sales of the "Covert Improved" Fireplace Throat and Damper we are pleased to announce to our friends and customers **a General Reduction of 10 Per Cent.** in the price of this specialty.

THE "COVERT IMPROVED" DAMPER

Used by the Canadian Bank of Commerce in various branches throughout Canada; the Ontario Provincial Government in Hospital installations; and in many other prominent buildings and residences.

Write for your copy of "Hints on Fireplace Construction"

Manufactured and Sold By

Black Building Supply Co., Ltd.

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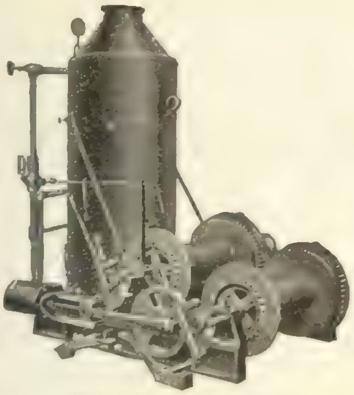

Standard Hoisting Engine

The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

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CALGARY—622 9th Ave. West—P. D McLaren, Manager.
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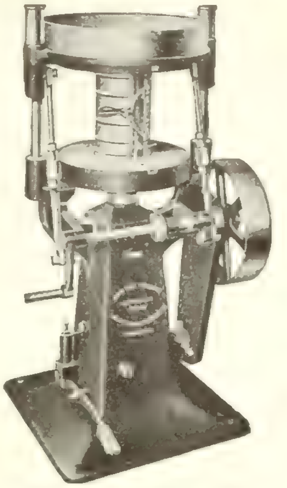
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

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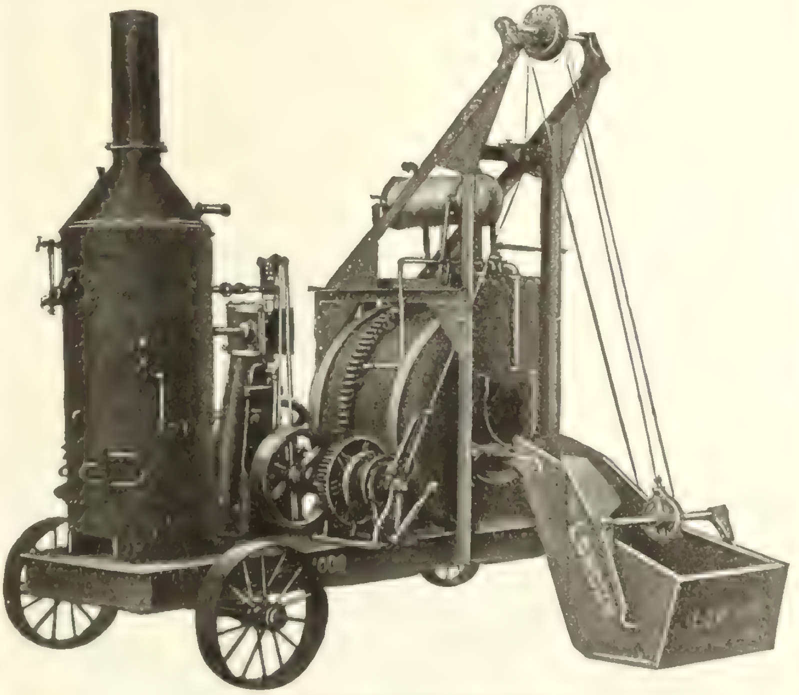
—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

—

Pumping Outfits

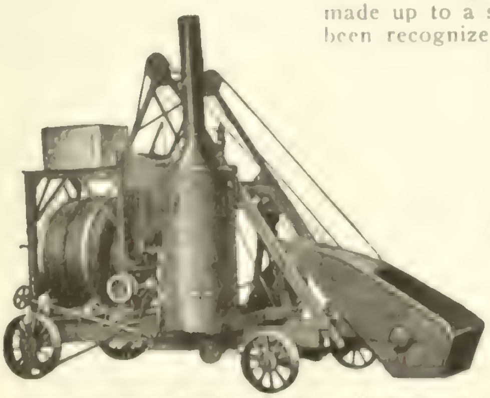
—

Hoists and Derricks

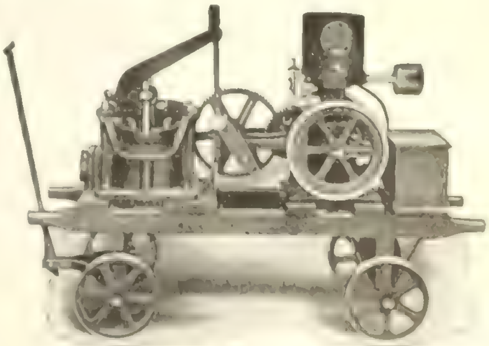
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

Correspondence Solicited.



Rear Discharge Paving Machine with Forward Loader



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Canadian Sirocco Co.
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Leonard & Sons, E.
McDougall Caledonian Iron Wks.
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Dominion Engineering & Inspection Company.
Farmer, John T.
Galt Engineering Co., John
Lea & Ferguson
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Mitchell, C. H.
Pullar, H. B.
Thorold Co., F. W.
Tyrrell, H. G.

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Austin Drainage Excavator Company, F. C.
Brown Hoisting Machinery Co.
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Sturtevant Co. of Can. Ltd. B. F.

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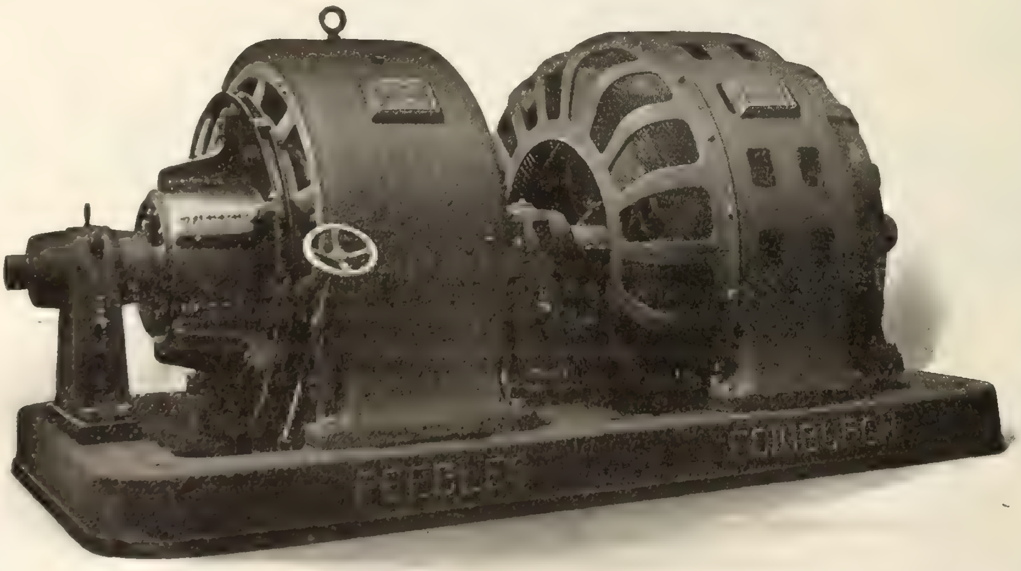

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TOOLS
It is plain to be seen
you are
losing money

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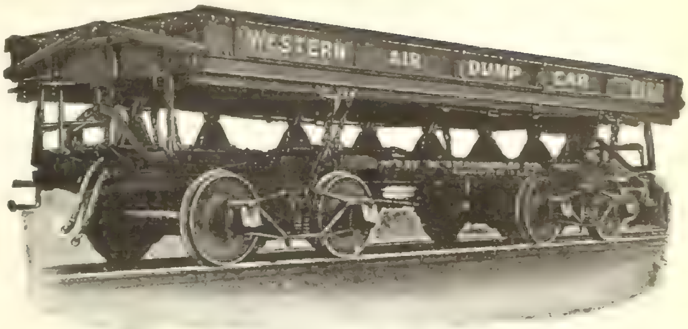

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constitute the most modern means for receiving, transporting and depositing earth, stone or other material.

The Western car is ahead of all other dump cars in points of economical operation, quality of material used, freedom from derailment, durability and superiority of mechanical design in general.

Strong endorsement of these claims was furnished by the engineers in charge of the Panama Canal when they selected Western Dump Cars for handling material during excavating operations.

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AURORA, ILLINOIS
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Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

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Hagersville - Ont.

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Excelsior Plate Glass Co.
Pilkington Bros.

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Star Dump Wagons—made with plain or roller bearings—comprise the following essential qualities of construction and operation:—
Handmade white oak spokes.
Black birch hubs—A grade rims.
Sheldon square steel axles.
Iron work wrought and drop steel forgings.
Short wheel base—most efficient draft from front axle.
Strong winding arbor and foot trip—Boiler plate armored neck.

Write for prices and Catalog.

Why Some Contractors Make Money

Because they use the most economical equipment.

Star Dump Wagons built for every service will save you 30 to 40 per cent. of your hauling expense. The Roller Bearing wagons will handle 3 yards as easily as 2 yards with the same team.

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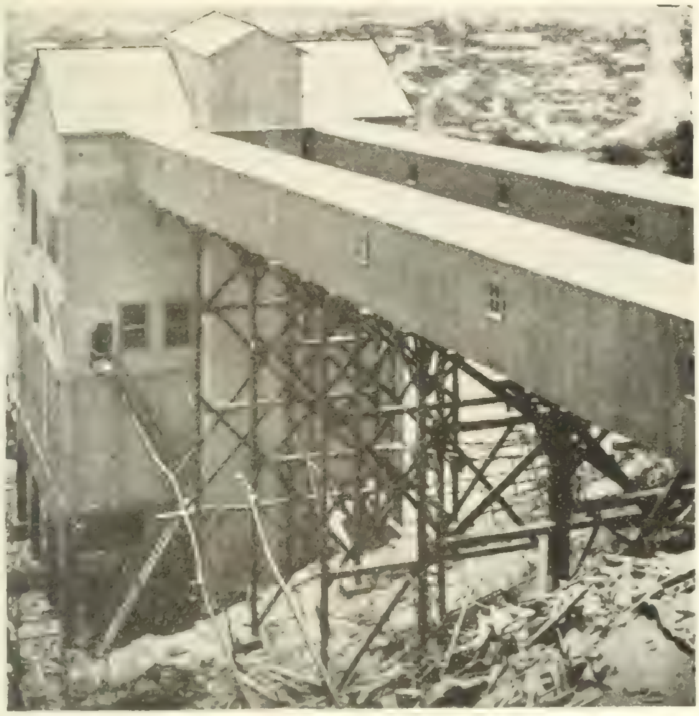
Canada's Departmental House for Mechanical Goods



Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

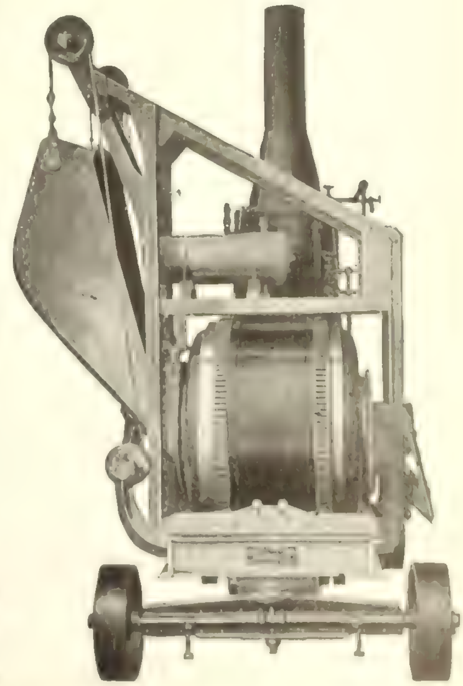
Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.



KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

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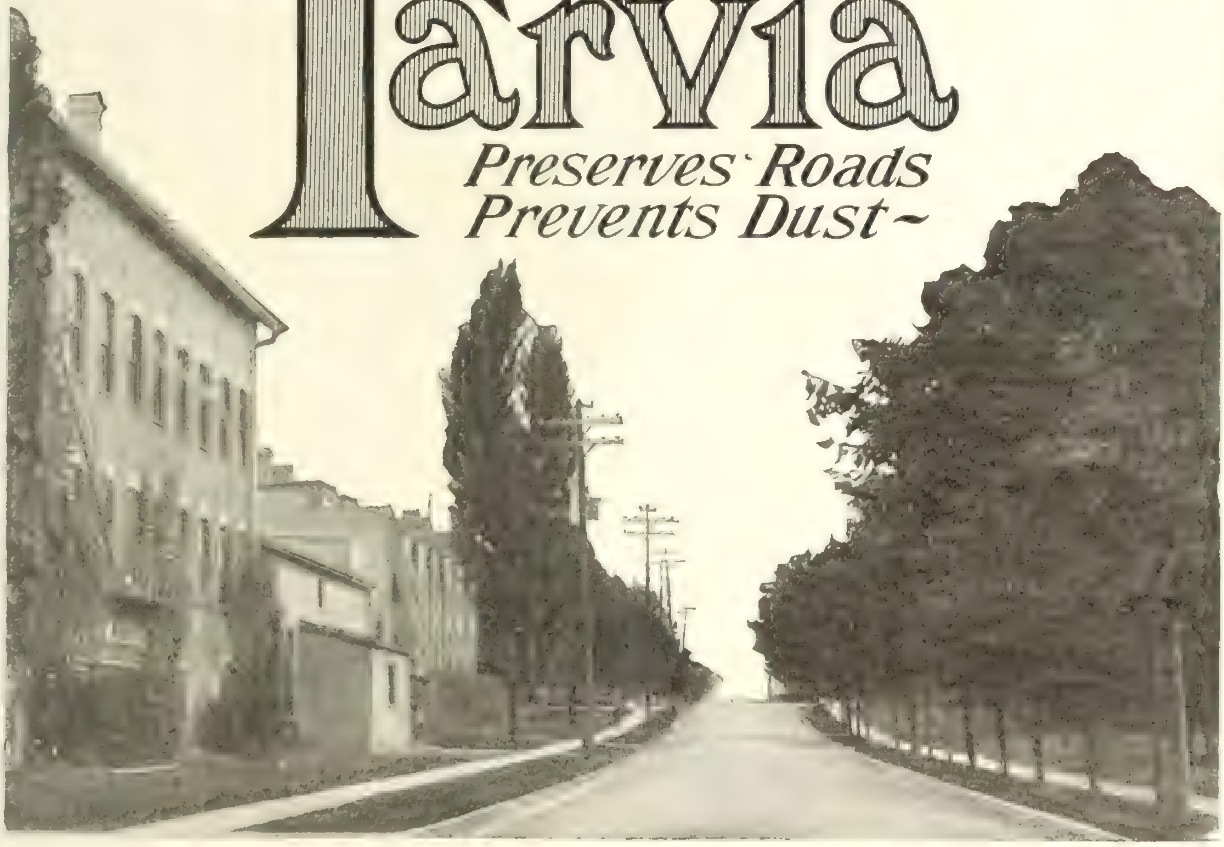
Tarvia

Preserves Roads
Prevents Dust~



Courtland Avenue Berlin, Ontario, constructed with Tarvia Modern Pavement in 1910 and in excellent condition today.

An economical roadway

The adoption of the tar treatment throughout England, France, the United States, and Canada has solved the question of good roads at moderate cost.

Tar acts as a binder, forming a perfect bond with the macadam and holding the lighter surface stone to the heavier base. It adds greatly to the life of the road and practically abolishes the dust nuisance.

The best known and most widely used tar preparation for roads is Tarvia. It is made in three grades "Tarvia X" is a dense, viscid coal tar product of great cohesive and bonding power for pavement and road construction. "Tarvia A" and "Tarvia B" are lighter materials of the same nature for dust suppression and road preservation.

"Tarvia X" and "Tarvia A" require heat for application. "Tarvia B" is applied cold.

As a rule a tarviated road lasts so much longer than ordinary macadam and reduces maintenance expense so materially that the cost of the Tarvia treatment is more than saved.

Illustrated booklet free on request.

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MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N.B. HALIFAX, N.S. SYDNEY, N.S.

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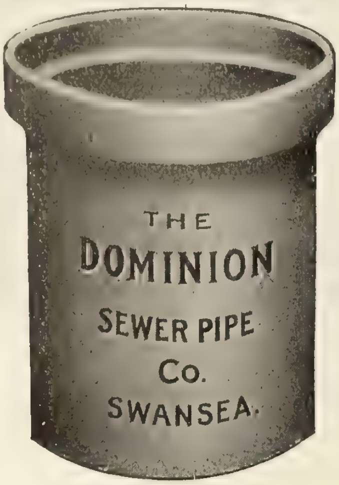

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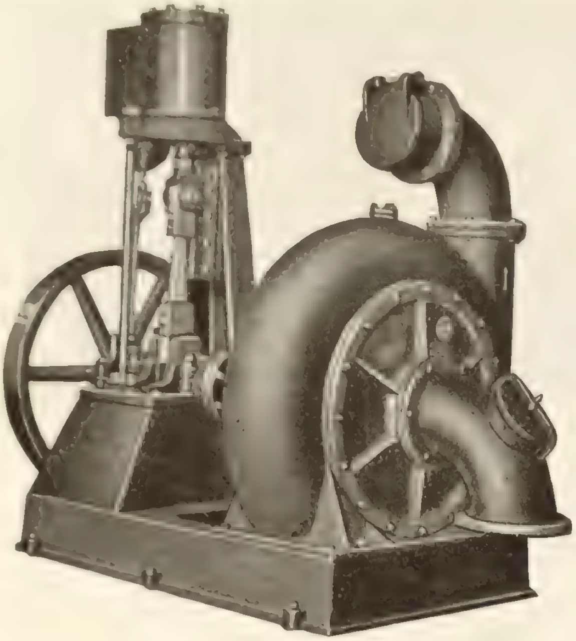

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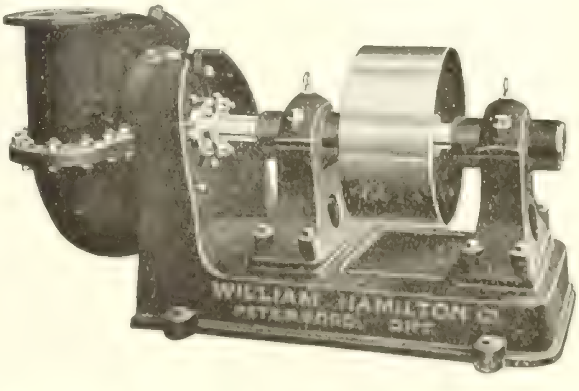

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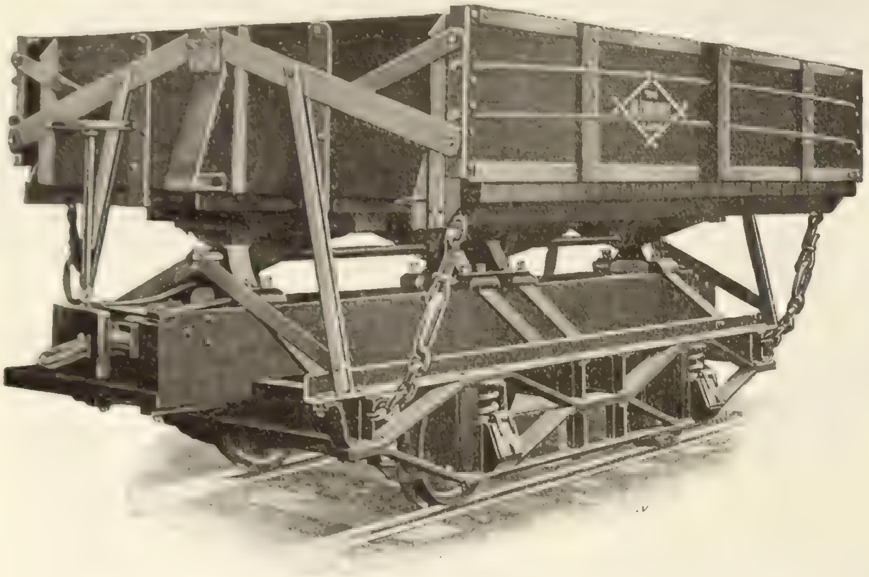

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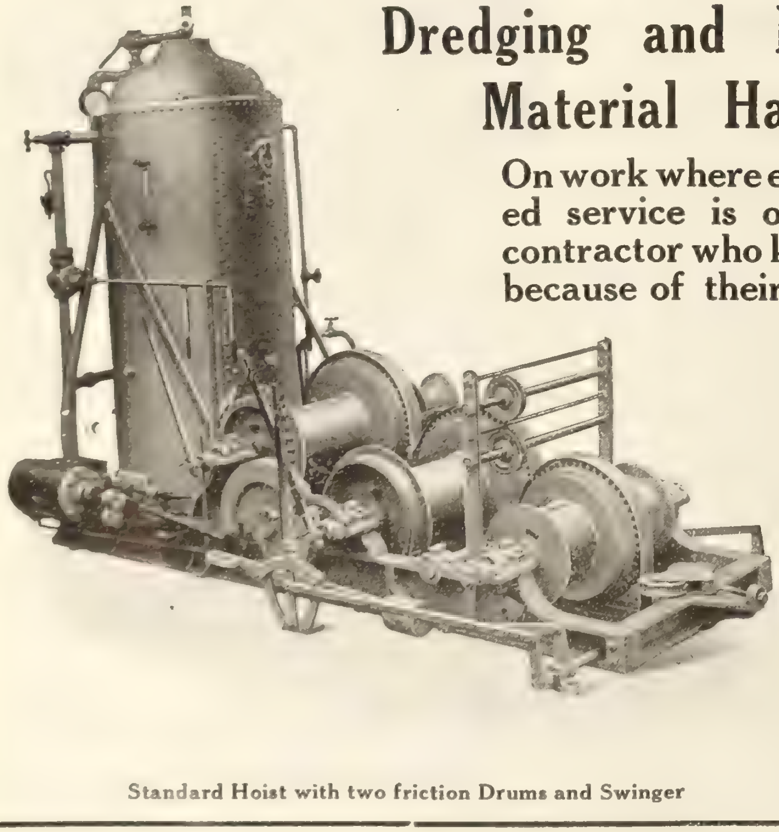

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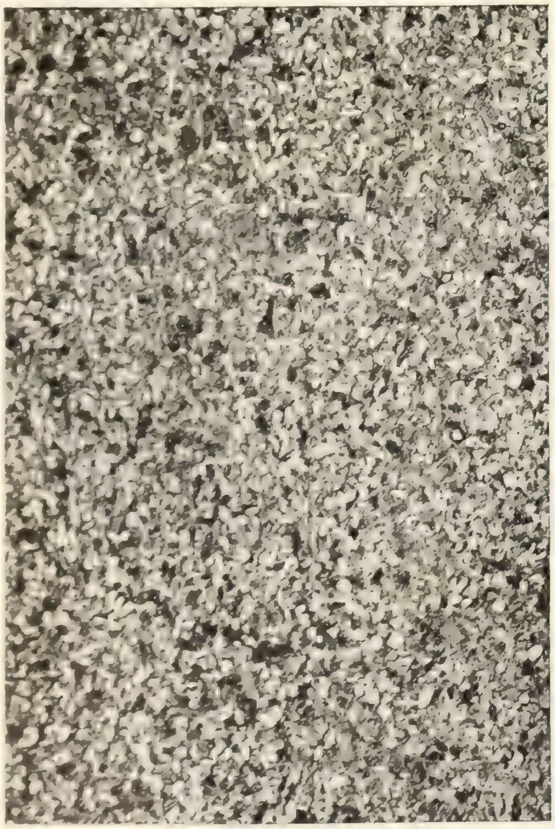

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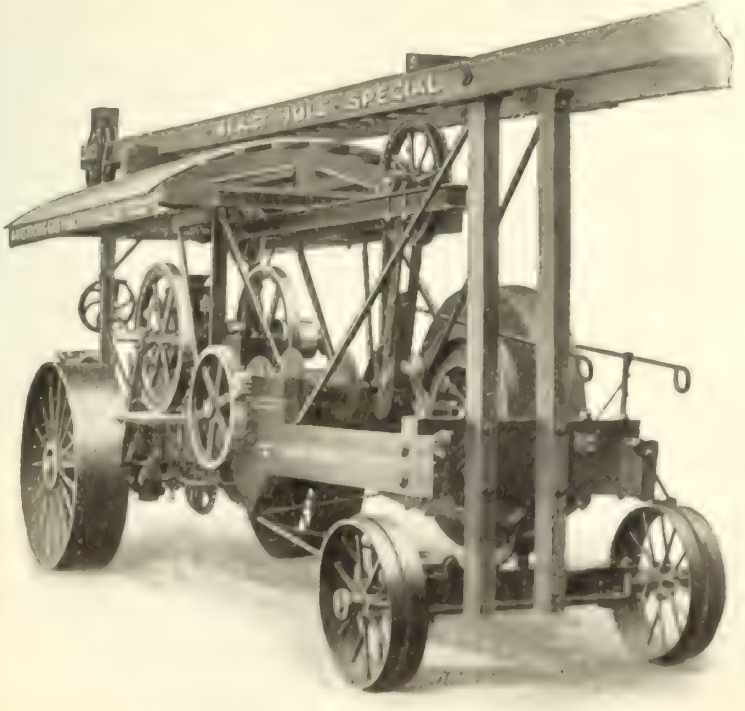

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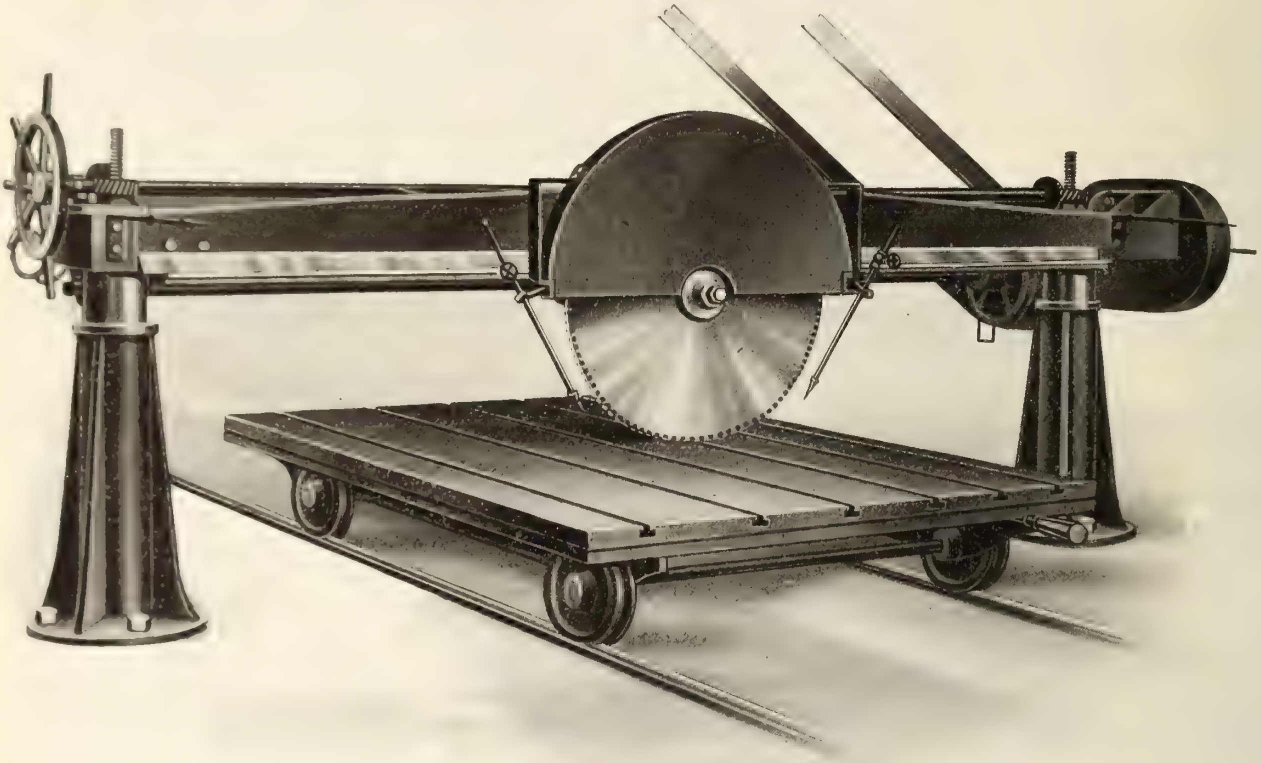

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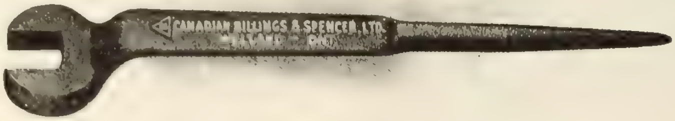

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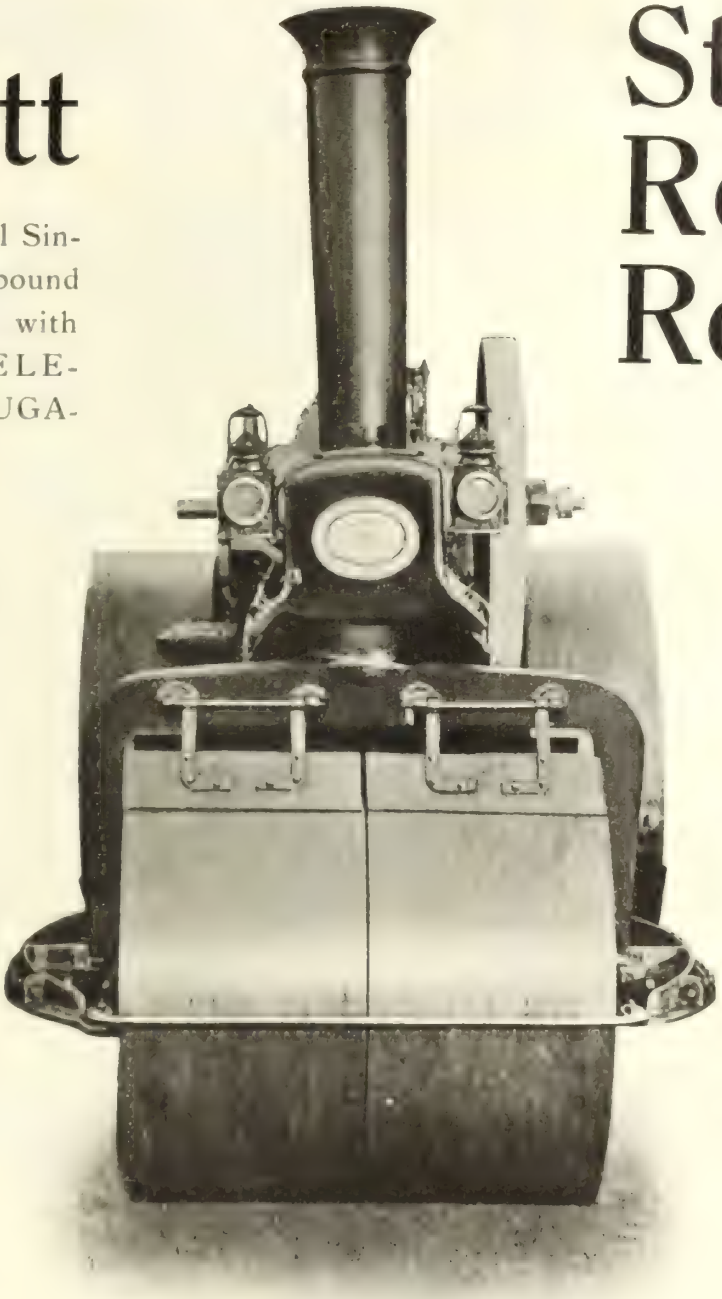

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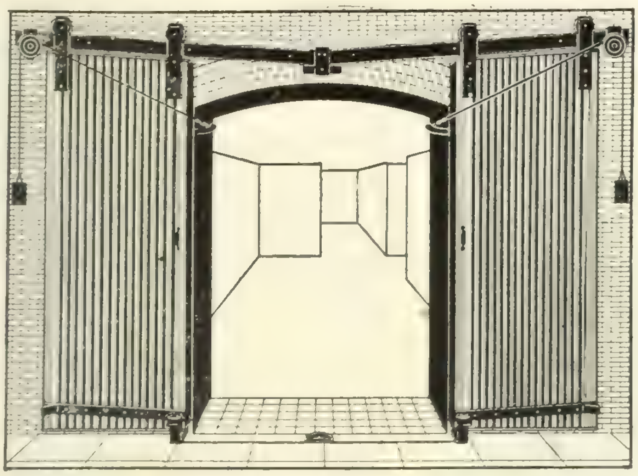

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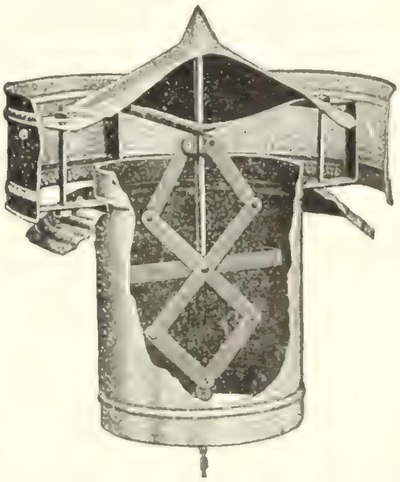

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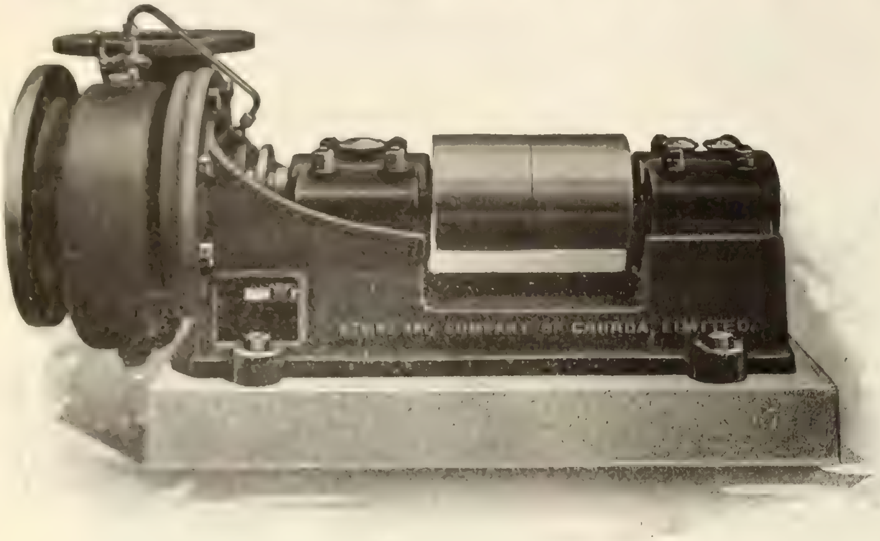

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Globe Drum — Semi-Steel, Correct Mixing Principle.

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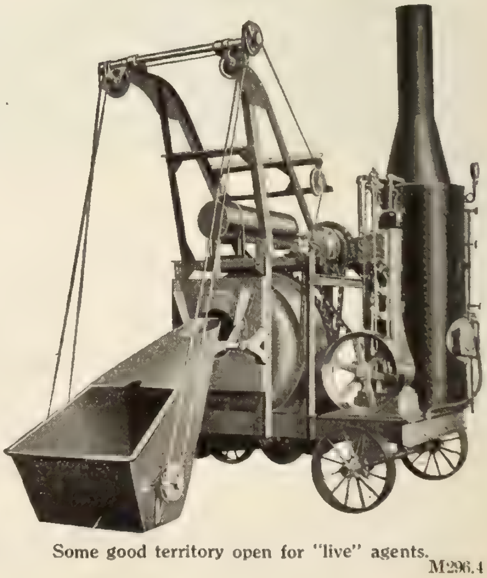
10 sizes, 4 to 100 cu. ft. per batch any power.
Street Pavers, 3 sizes, 9-12-20 cu. ft.



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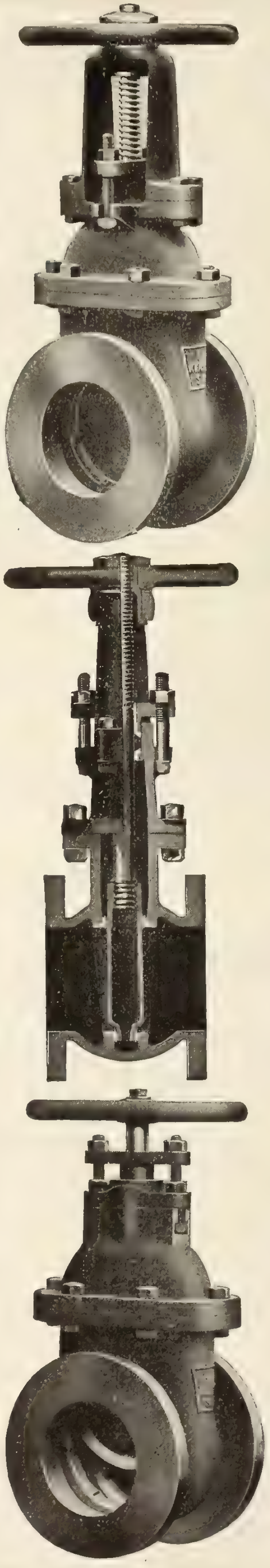

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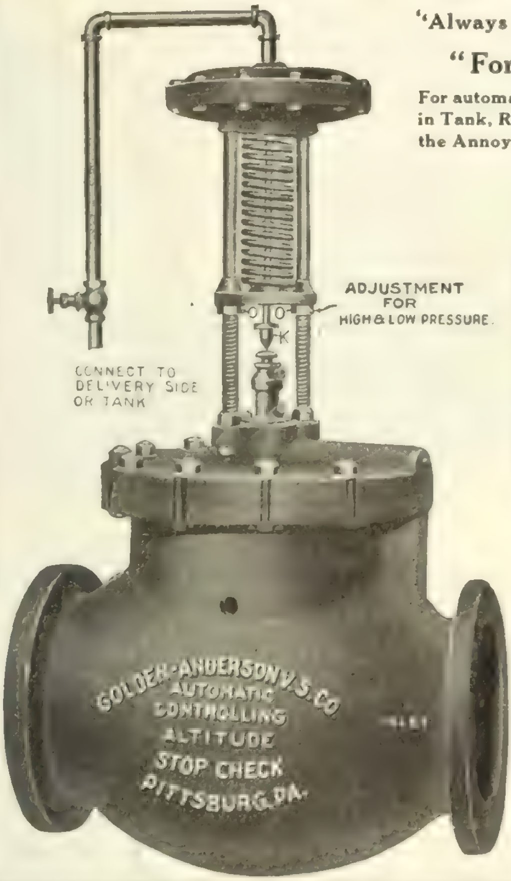

"Always Cushioned in Opening and Closing"

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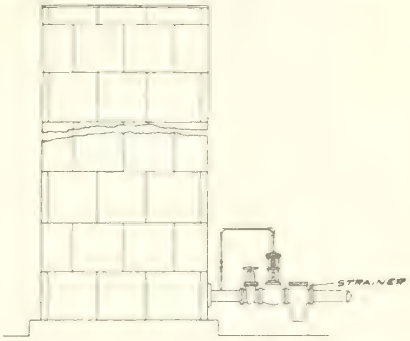
For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.



Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.

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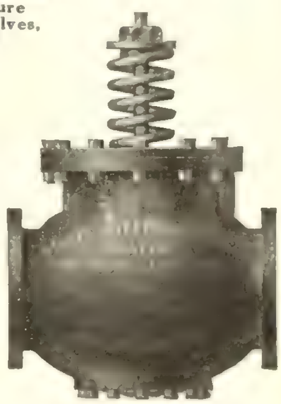
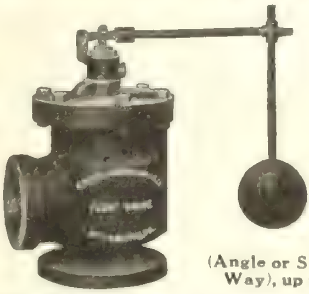


Golden-Anderson Float Valves



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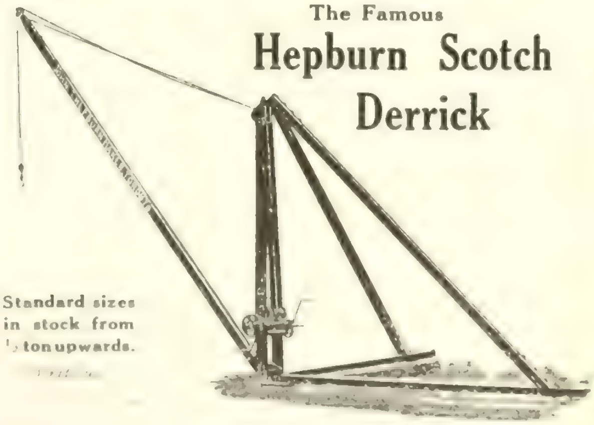
Hepburn Scotch Derrick



Standard sizes in stock from ½ ton upwards.

These Derricks can be fitted with steam or electric power if necessary.

Hepburn Derricks are thoroughly tested before leaving our yards. They embody strength and simplicity of construction, and are guaranteed to give maximum satisfaction under the most exacting conditions. Prove this for yourself.
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Our factory is specially designed to produce enamel concrete brick of the highest quality. 3,200,000 pounds of pressure is exerted on every eight brick in the process of manufacture. Think of the meaning of this statement in connection with the permanency and durability of the product.

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Purity

Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

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that you can Afford

to pass us by before getting our prices on your requirements or before putting in your tenders on

Plate Sheet Fancy

or any kind of

Glazing Glass

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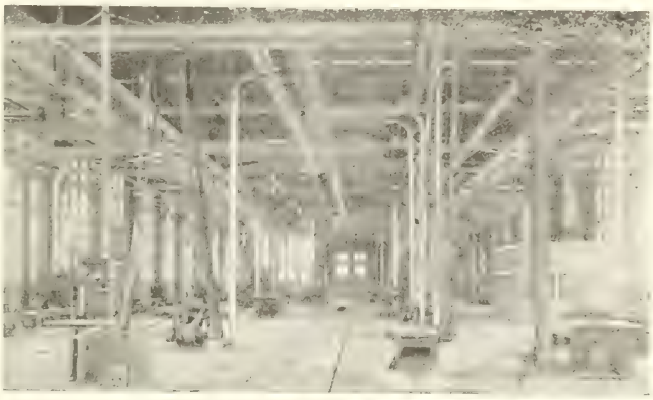

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No matter how exacting the conditions—or how great the wear and tear your client will never have cause to complain when you install

J-M Mastic Flooring

Heavy trucking that knocks the life out of concrete and wood floors in less than no time has little effect on this durable flooring. Being a finely divided mineral aggregate cemented together with the best grade of natural asphalt, it is practically indestructible

Yet with all its toughness, it is resilient to the tread. Does not cause fatigue from foot-soreness—therefore contributes to the efficiency of operatives in industrial plants.

Noiseless--non-slippery—absolutely sanitary. Does not originate or hold dust. Does not absorb oil, grease or filth. Quickly cleaned by flushing. Unaffected by acids.

Our staff of waterproofing engineers will gladly co-operate with you on any job of flooring or waterproofing.

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Write to us for catalogues and information.

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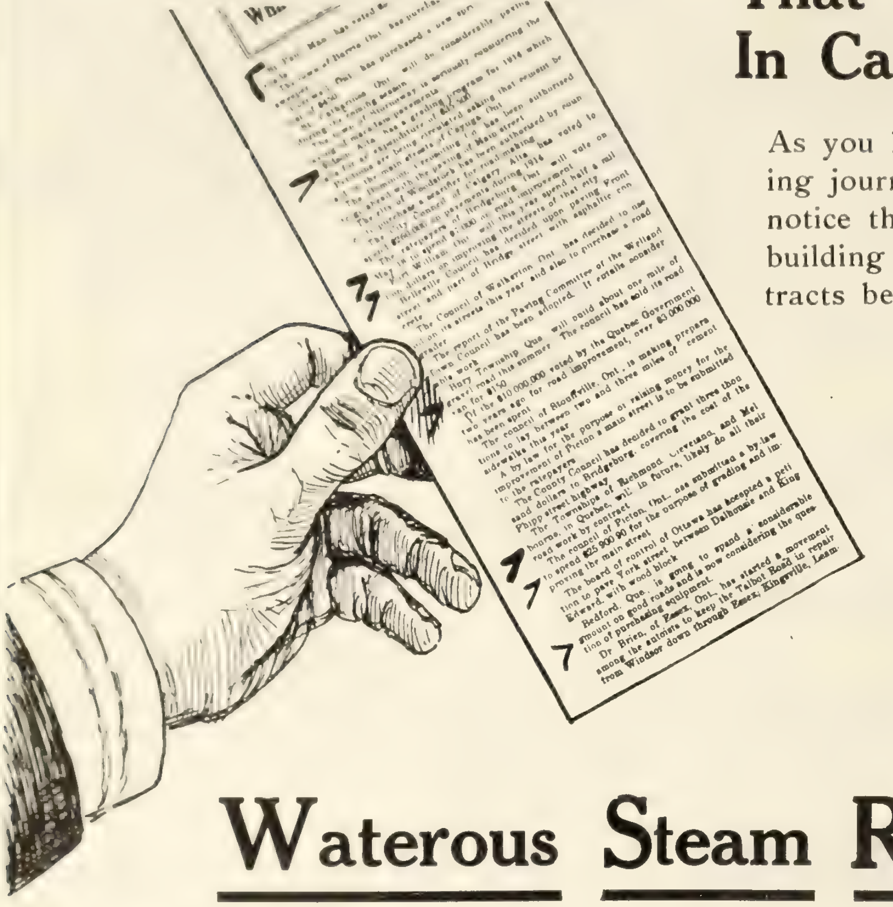
Check Over The Road Improvement Work That Is Being Done In Canada—



As you look through your engineering journal week after week, you will notice the ever increasing list of road building and road improvement contracts being opened up.

In every part of the country the demand for more roads and better roads has been voiced. As a result, it is estimated that sixty million dollars will be spent this year to improve Canada's highways.

Do you realize one vital fact?—That more than 75% of this work will be done with

Waterous Steam Road Rollers

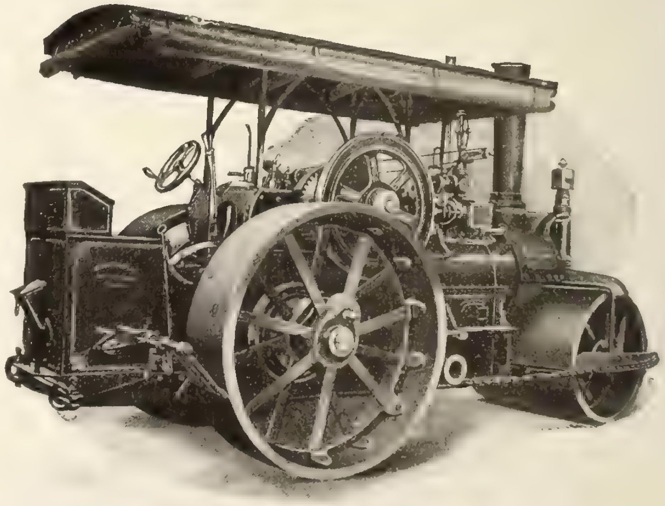
At present there are 170 Waterous Steam Rollers in use in Canada—a great many more than all other makes combined.

These machines are in the hands of those municipalities and those contracting engineers who are doing big things in building Canada's better highways and finer streets.

Some of them have used the Waterous to build the finest roads in the Dominion—added together, they have constructed something like eight out of every ten miles of improved road that Canada possesses. They have consistently used the Waterous for the work.

The Machine itself is the "Reason Why."

We will gladly send you our list of users. Any one of them will answer your questions as to the quality of the Roller—That is all we ask.

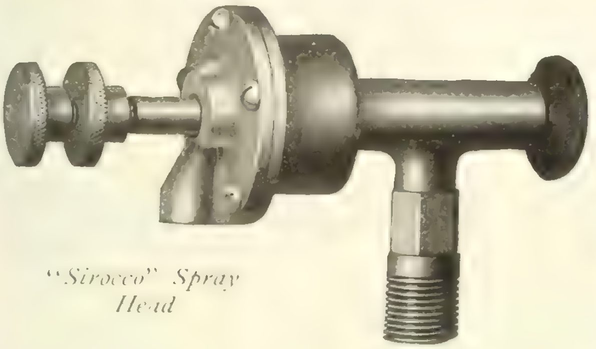


The Waterous Engine Works Co.

Limited

Brantford, Canada

MADE IN CANADA



"Sirocco" Spray Head

It's the design and operation of the spray heads that's responsible for the efficiency or inefficiency of an air conditioning system.

"Sirocco"
TRADE MARK.

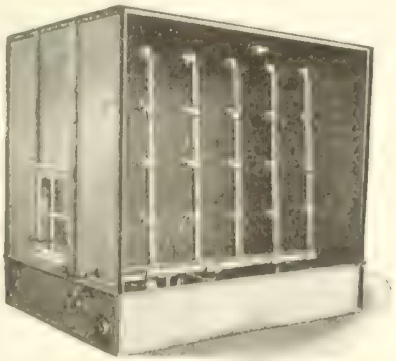
Purifiers, Coolers and Humidifiers

are equipped with spray heads which were designed to overcome the usual "clogging up" trouble. All heads can be flushed simultaneously by slightly turning a three-way cock located on the **outside** of the Purifier.

All heads are adjustable as to density of spray and can be permanently set at any desired point by means of a lock nut.

All heads are made of brass and accurately machined to template.

No packing is used.



Purifier Complete

Architects, Engineers and Contractors are invited to ask us for any information whatsoever regarding the design, construction, operation and application of Sirocco purifiers, Coolers and Humidifiers.

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Residence of Joseph Bagnarello, Freeport, N.Y. Cellar waterproofed thoroughly against 12-in. ground water pressure by the use of CERESIT. Read the following letter about this job.

"You Surely Understand Cement Waterproofing."

Mr. A. S. Johnson, Freeport, N.Y.

Dear Sir:—The work you did last Spring at my residence in waterproofing the cellar has proven a great success, and I feel you gave me a good job, hence, my money was well spent.

You surely understand cement waterproofing. I will gladly recommend you as an expert in your line, and can say you give full value when you make a contract.

You can use my name any time you wish in this connection, as I take pleasure in recommending your work.

Yours truly,
(Signed) JOHN BAGNARELLO

CERESIT
TRADE MARK

The Dependable Waterproofer for Cement

Mr. Johnson uses Ceresit. He has landed many large contracts for waterproofing leaky cellars. You can do the same. USE CERESIT. Get the facts by writing for our "BOOK OF EVIDENCE."

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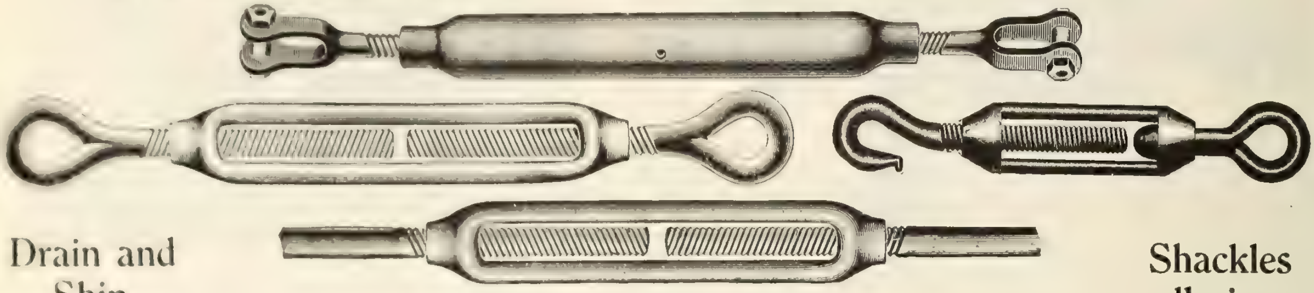
Mast Screws or Turnbuckles

27 Styles Sizes 3 16 to 2 inches and in lengths from 2 to 72 inches.



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Pumps
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Russell
Loud
Patterns

We are manufacturers of a large line of

Contractor's Supplies

also the famous

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Stronger than same size chain and corresponding to it.

Shackles
all sizes
3/16 to 2 1/2
12 Styles
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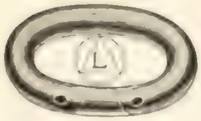
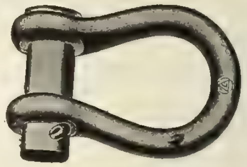


The Thomas Laughlin Co.

Portland, Me., U. S. A.

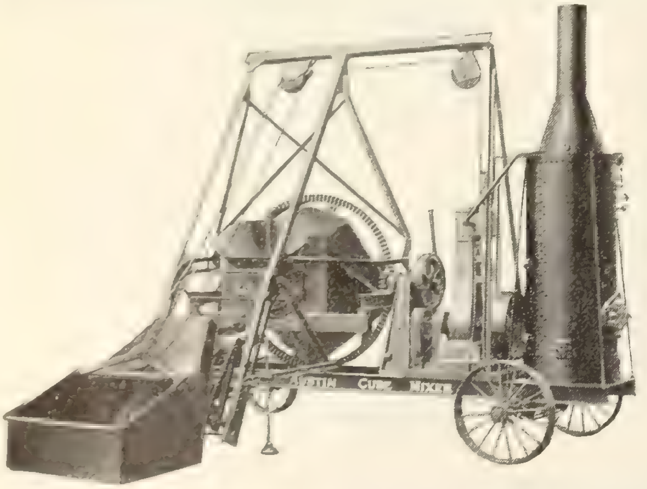


Concrete for the Los Angeles Aqueduct was mixed in Cube Mixers

The Los Angeles Aqueduct, one of the world's projects that ranks in importance with the Panama Canal, cost $23,000,000. An immense mass of the ***highest quality concrete*** was required in its construction—and practically ALL of this concrete was mixed by the AUSTIN CUBE. It is significant that on the world's biggest concrete jobs engineers choose

The AUSTIN Cube Mixer

It's peculiarly significant when you stop to consider the requirements of concrete mixing on work like the Los Angeles Aqueduct, the Sweetwater Dam, the Detroit River Tunnels—on SUBAQUEOUS work—all AUSTIN work.



Such under-water and water-carrying construction tests out the quality of the concrete mix, its uniformity, its denseness, more severely than does any other work.

At the same time, concrete records for speed of production must be kept up—the job must pay from the labor point of view. Engineers want speed as well as QUALITY—and for that reason the Austin CUBE is called upon.

Everything goes to prove that the Austin Cube principle is right.

Not only is the principle correct, but the charging, driving, discharging and delivery systems are also noteworthy for power economy and for speed. Three batches of perfect concrete to two of any other mixer's is an Austin record that has been made many, many times.

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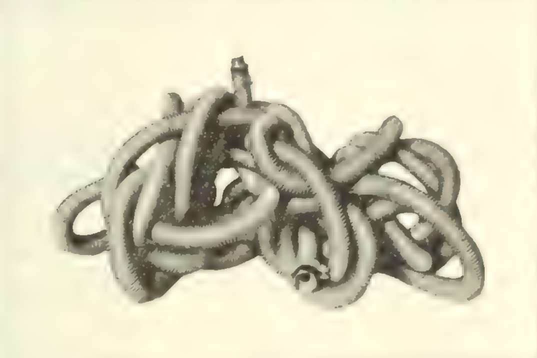
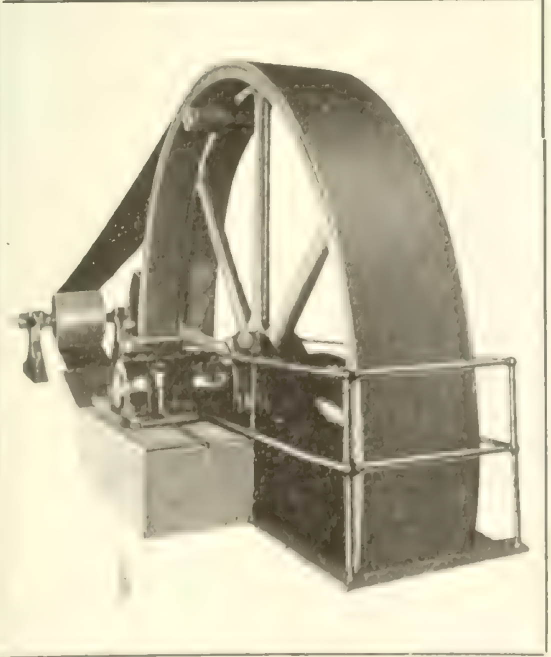
Price vs. Service

One Is What You Pay---The Other Is What You Get When Buying Equipment





When buying hose, or belting, or packing, remember that quality always takes care of economy

You wouldn't consider equipment that you could have free. Then why **pay** for unknown quality?

In Goodyear equipment—whether hose, belting, packing or valves—each product is made to set an exact **service** standard—each brand is made to meet a specific need.

Every man employed in the making is an expert. Every ounce and inch of material is laboratory tested. Every process of manufacture is the most modern and scientific. Goodyear efficiency experts first determine the exact need, then design the exact Goodyear product for it.

It costs nothing to consult these men. They will be glad to confer with you at any time—tell you just what Goodyear product meets your need—and why!

GOODYEAR
TORONTO

Goodyear Hose includes everything from hose for suction purposes to heavily armored hose for **every** purpose—every pressure.

Ask Goodyear experts to tell you of these products—how they're made—of the exact service for which they have been designed.

Whether your need be for suction, steam, water, air, gas or pneumatic tool hose, there is just the particular Goodyear product for the very purpose.

Belting --- Packing --- Valves

Or, if your need be belting—from the Goodyear [illegible] belt for main drives to lightest high-speed belts for small swift pulleys—remember Goodyear.

In packings and valves this same exact complete Goodyear **service** idea governs

This Service Free

It costs nothing to have the Goodyear [illegible] help you. Consult these men not only when you're in doubt, but when you're "pretty sure." Some money-saving [illegible] you.

Remember that Goodyear quality dominates in this field as in auto tires. And Goodyear equipment is made in Canada, in the most completely equipped factory in the Dominion. Write NOW

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Roofs, Steel Buildings and Structural Iron Work

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Designs and estimates promptly furnished.

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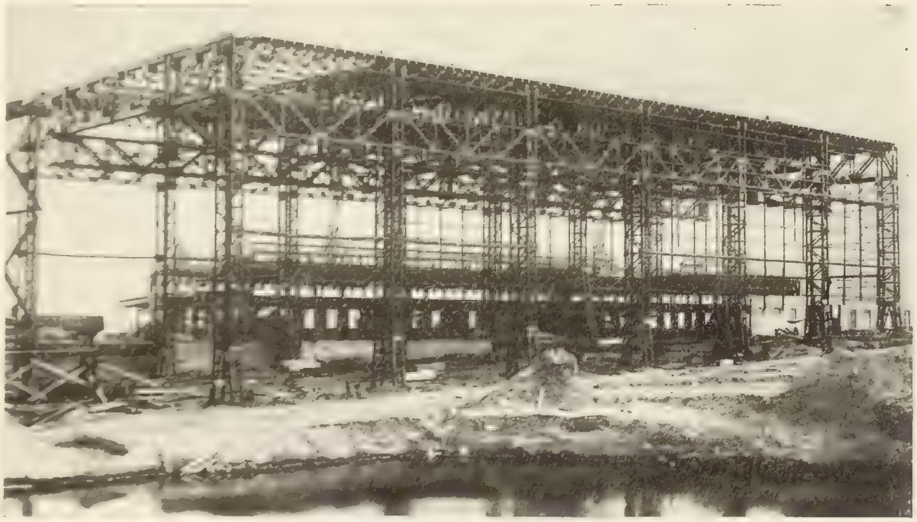

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ESTABLISHED 1886

Contract Record and Engineering Review

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SUBSCRIPTION RATES
Canada and Great Britain, $2.00. U. S. and Foreign, $3.00.
Single copies 10 cents

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Important Aspects of Contract Reform

THERE are contractors and contractors—and how some men ever got into the business is a matter of speculation. When two men figure on the same piece of work and there is a difference of one hundred per cent in their bids it may be asserted without fear of contradiction that either one of them has mistaken his avocation or there is something wrong. It may be argued that such a difference may be occasioned by carelessness on the part of one of the bidders. To this we reply that the careless man should have no part in contracting, for his estimates can never be accepted with any reliability.

Recently we had occasion to examine the figures submitted for the construction of an exhibition building and we noticed that the low bidder was $58,000 under the next man and $145,000 under the highest bidder. Another instance is where a contractor secured the job of building a concrete sewer for rather more than $50,000, or $33,000 under the highest bidder. In a recent award of sewer work in the West the price of the low bidder amounted to $135,000, while the highest bid received was well over $200,000.

Whence such discrepancy? If it were possible to carry out the work at the low price, then the man who submitted the high bid would have made a remarkable profit, while the conditions reversed the low bidder would have incurred heavy loss. It is possible that for some unforeseen reason the high bidder did not want the contract and that the low bidder wanted the work badly and was willing to take it at a small profit, but even such speculation cannot altogether explain such disparities.

We are inclined to think that only too often the fault lies with the low man. He makes omissions, under-estimates the equipment and labor required and "cuts" his figures to a point which reduces the job to an economic absurdity. Such men are the bane of the contracting business and they should not be in it. As the "lowest" contractors they rob the good man in the business of many a legitimate prize, only to drag the trade into disrepute by reason of the scamped work they find necessary to recover part of their profit.

Contracting is essentially a business which should be conducted fairly and squarely. The incompetents and those who prostitute the business to the lowest principles of selfish gain should be eliminated. One may ask how reform can be accomplished in a day when so much depends upon dollars and cents. To this we can only reply that much can be achieved by individual effort and by united action on the part of the various constructional bodies looking to the promotion of efficiency and the setting up of a higher standard of ethics in the business. We shall always have to deal with incompetency, but as time goes on the incompetents will become fewer, as in the rush of competition it will be a case of the survival of the fittest. It is upon unscrupulousness, then, that we may concentrate, having for our watchword, "Efficiency."

It is not enough to refrain from immoral practices in contracting, one must not condone them. If we are satisfied that one of our associates in business is dishonest the only course to pursue is to cease to know him. If the few dishonest contractors were thus ostracised in the business they would find it hard to obtain credit outside of it, for there is still something of value in a good name. Reputation will always count.

If, then, we work for a higher standard of efficiency, we shall arrive at a point where incompetents will have no place in contracting. If we establish and observe a high code of ethics, and bring about certain reforms in the manner of awarding contracts, we shall place the legitimate prizes which contracting offers beyond the reach of the unscrupulous. Then, perhaps, we shall find less disparity between the high and low bids; and then, perhaps, it will be necessary to cast about for fresh editorial topics. At present, these matters, like the poor, are always with us.

Co-operation Productive of Close Bidding

THE desirability of calling for bids with a view to encouraging bidders and close bidding is a topic of editorial consideration in a recent issue of Engineering and Contracting. The article is a timely one, for such shortcomings on the part of many engineers—in Canada at any rate—have been notorious.

To our mind it is only too often a case of the right order of things reversed through unnatural developments. How often do we not find the government employee, a servant of the public, according such treatment to the public who pay him as to turn conditions topsy-turvy, making the public subservient. With the engineer the basic defect is the same. He loses balance—becomes top-heavy with an exaggerated sense of his own authority.

The impartial attitude towards contractors which the engineer has to observe does not preclude his giving that assistance which is absolutely essential in the best interests of the work. As our contemporary points out, the engineer and contractor should be co-workers, entitled to a joint knowledge of all facts bearing upon the cost of performing the work.

A call for bids has two main objects—one, to securing a structure of specified design and structural integrity, and the other, to secure this structure at lowest cost. To attain these objects close bidding must be made possible and the only way to do this is by eliminating uncertainties as to construction.

* * *

THE LOWEST RESPONSIBLE BIDDER

Not many moons ago there was a prolonged discussion in this journal of a suggestion (made originally by a writer who is now the London correspondent of the Contract Record) to award tenders not to the lowest bidder, but to the lowest bidder but one. Practically every conceivable argument was adduced, but the preponderance of opinion was in favor of leaving matters as they are. Now the matter is revived by an editorial discussion in the Chicago authority mentioned above, it having already been shown that the lowest bidder and the lowest responsible bidder on a piece of work are often different contractors.

Certainly we are entirely in accord with the finding that one of the greatest faults in the application of the contract system of doing public work is the award of contracts to lowest bidders who are not properly qualified to carry their contracts to successful completion. We quote from our contemporary, Engineering and Contracting, and commend the principles to our readers:

> This evil is becoming better recognized and there is a growing tendency to award contracts to the lowest responsible bidder rather than to the lowest bidder. Theoretically this has always been the case, but actually the vast majority of contracts for the building of public works have been awarded to the bidders submitting the lowest bids regardless of their other qualifications. This practice has been by no means limited to small towns or even to municipal works; in fact the practice has been all too general.
>
> The two quotations which follow indicate the growing disapproval among engineers of the practice here condemned. In discussing a paper on the state supervision of dams and reservoirs, presented before the New England Water Works Association, Mr. M. O. Leighton, chief hydrographer of the United States Geological Survey, said in part:
>
> > Consider the contractor. It is undoubtedly true that many dam failures have been caused by poor work on his part. You know the predicament of a contractor who is losing money on his job, and how easy it is to consider the fact that he is losing money and therefore to allow a little indulgence here and there. To secure a good piece of work under such conditions, eternal vigilance is usually necessary, and few of us measure up to eternal vigilance. One of the best ways to obviate such a difficulty is to abolish that absurd and antiquated regulation which prevails, especially in public work, that the contract shall be awarded to the lowest bidder regardless of the cost and the difficulties and regardless of the real responsibility of the man. In 90 per cent of the cases, and probably more, the expense, trouble and delay caused by a defaulting contractor who is awarded a job at a too low price, more than exceeds the difference between the successful bid and the rational one.
>
> Plans and specifications insure good construction, as a rule, only under rigid inspection. Mr. Leighton's comments bring out a point which should be more generally appreciated by those who award contracts, that is, the human element must be considered in its relation to the rigidity of inspection when a contractor is losing considerable sums of money. The responsible contractor is one who will do good work even though at considerable financial loss to himself, but this type of contractor seldom bids too low in these days of basing bids upon carefully prepared contractor's cost estimates.
>
> In his latest annual report, Mr. Charles A. Finley, superintendent of the Pittsburgh Bureau of Water, comments as follows upon the folly of awarding contracts to the lowest bidder, regardless of other considerations. To quote:
>
> > The unfortunate and unwarranted delay in some of our new work calls attention to the necessity of more rigid determination of the ability of bidders to execute the terms of contracts. These delays have arisen from lack of management. The provision in our specifications, that the bidder shall have the necessary organization, capital, experience, etc., to execute the terms of the contract, should be made to mean just what it says. The fact that a bidder is the lowest bidder should not secure for him any consideration unless he had demonstrated the ability to execute such a contract.
> >
> > A competent contracting organization is just as essential to satisfactory results as is the engineering organization which designs and supervises the work.
>
> Mr. Finley specifically names three of the most noticeable and annoying examples of delay in the completion of contracts in the recent experience of the Pittsburgh Bureau of Water. He states that in each of these cases bids were received from contracting organizations which had demonstrated their ability to comply with the progress required in the contract. They were not the low bidders, but in each case the city has lost money by awarding to the low bidders.
>
> The popular adherence to the low bid regulation undoubtedly comes, in part, from the belief that a

higher degree of honesty is present when contracts are awarded to low bidders rather than to relatively higher bidders. There are evidences that this simple faith is passing. Enough stories exploiting the smart tricks of those who graft on public works have been published in the popular press during the past few years to impress upon the more intelligent of the general public that if a disposition to graft is present the low bid regulation is easily surmounted. The public should now realize that the awarding of a contract to a high bidder for the purpose of "getting in" on the difference between his bid and the low bid is regarded as case A-sub-one among the simple forms of double-dealing under the contract system, and as much too crude a method to be employed with safety. So well is this ancient form of grafting understood that awarding a contract to anyone but the lowest bidder should be inferential evidence of the honesty of the award rather than the opposite.

The engineer-in-charge is best qualified to judge of the sufficiency of a bid and of a contractor's qualifications. If he sees reasons why the low bid should be rejected he should not hesitate to recommend that it be rejected.

The Engineer's Estimate from the Viewpoint of the Contractor

ONE of the most interesting discussions that we have read for a long time, and one which contains much sound common sense, applicable to the practice of both the engineer and the contractor, is contained in the presidential address of Mr. P. R. Fletcher before the Illinois Association of Municipal Contractors at their recent annual convention in Chicago.

Mr. Fletcher shows how unreliable and misleading the engineer's estimate often is, owing to the fluctuation of labor and material, and shows the necessity of having such figures prepared by a man of wide experience who has kept cost accounts on actual construction work. Low estimates, Mr. Fletcher points out, often result in failure to let the contract and abandonment of the proceedings. Sometimes the letting of the contract above the estimate necessitates a supplemental assessment or the award of the contract to an undesirable contractor. Mr. Fletcher continues:

Less than a decade ago estimates of cost, both by engineer and contractor, were generally mere guesses. Both, however, are beginning to realize the value of keeping construction costs, methods and costs are taken into consideration, so that a better understanding now exists as to the difficulties to be overcome in construction work.

Though every engineer and contractor has a different method of making estimates of costs, in the main and important details they are similar. For example, any one estimating the cost of concrete per cubic yard can obtain prices from the dealers on the aggregate, sand, cement, steel and lumber. The exact amount of each material needed for a cubic yard can be calculated and set down without any guessing. There are only two items—the cost of mixing and placing and the cost of erecting and removing forms, both items of labor—that remain to be estimated. By consulting some practical concrete man who does this kind of work, or taking it from cost records, the estimator can ascertain the cost of these items. Adding to its allowances for plant and general expenses, the contractor's legitimate profit and discount of paper, he has a fairly accurate estimate. This method reduces guesses to a minimum, and instead of a guess in a lump sum, what little must be done is confined to a few items, generally a small per cent of the whole. Those who follow this method and do much estimating will soon learn the various man and machine units of work per hour or per day, so that the only uncertain element of labor cost will be the fluctuation of wages.

There are many conditions which affect the fluctuations of wages. Men may be plentiful when a job starts, but wages may increase, due to the beginning of other work in the same locality or generally good business conditions, and labor become difficult to obtain. In many cities, labor unions are in control of the situation and a union scale of prices is in effect and must be met. In many smaller villages and cities, no satisfactory floating supply of labor is to be obtained. The contractor must import laborers and provide a place to sleep and feed them, an added cost on small contracts. Wages paid to local labor are always higher for an outside contractor than the prevailing local scale, usually about a 25 per cent increase.

Local laws may also affect the labor costs. City ordinances imposing regulations on maximum loads, etc., may increase the cost of the work. The engineer must look fully into the wages paid in any locality where work is to be done and also into the many conditions which might arise.

Importance of Allowing for Contingent Costs

In the case of materials to be used, there should never be any guess work as to their cost. Before the estimate is compiled, prices of all materials, based on the approximate amount needed, should be obtained in writing from the manufacturers or dealers. In the request for such prices, it should be stated what the materials are for, and about when and where they will be required.

Every contractor is familiar with the items of contingent cost encountered in nearly every specification. He reads them over and says to himself, "Oh, that isn't much; that doesn't amount to anything." It does not, if there were only one; but, taken in the aggregate and put into dollars and cents, it represents a large item of cost. If he does not figure it, his profit is reduced; and the probable reason he has never figured it out is that he could not get his bid under the engineer's estimate if he had—for the very reason that the engineer had omitted it also. Here is the big question: "Do engineers ever figure the contingent cost and add it to their estimated cost?" I believe that here is the true reason why many estimates are too low.

The following items of contingent cost enter into nearly every contract: 1. Expense of looking over the proposed work, attending the letting and closing the contract, if successful; 2. Attorney's opinion as to legality of the special assessment proceedings and bond issue; 3, Cost of the surety bond; 4, Cost of maintenance bond; 5, Cost of the liability insurance policy; 6, Moving outfit to and from the work; 7, Plant maintenance; 8, Tools lost, broken and stolen; 9, Wasted material; 10, Demurrage; 11, Losses due to weather conditions and damages of the elements; 12, Pay roll and expense of outfit in rainy weather; 13, Pay roll of superintendent and foreman for three months of the year, when not at work; 14, Local charges for use of water; 15, Broken drain or water pipes; 16, Unforeseen damages to walks and private property; 17, Cost of inspection of materials; 18, Stakes and help for the engineer; 19, Barriers and red lights; 20, Lost, torn or damaged cement bags; 21, Being a good fellow.

I could explain each of these items more fully, but the mere mention of them will suggest many instances to every contractor. Every one of these items enters into the cost of an improvement. Each is as much an item of cost as labor and material. Taken separately, they amount to but a small sum, but in the aggregate they total from 10 to 15 per cent. of the cost of an improvement. How many engineers take cognizance of these items and include them in their estimate? Yet their specifications and contracts call for them.

No business can succeed without profits, and no contracting company can succeed, and stay in business, without them. This leads to the question, "What constitutes a fair net return on municipal work?

The contractor's profit depends on the price he bids for the contract, and often varies for the same class of work. In early spring he may bid very low, to get his organization ready for the season, especially if he carried no work over from the preceding year. Later on he, perhaps, obtains contracts at legitimate prices, thus averaging up on the year's business.

On force account work, with every facility at hand to do work, the usual allowance for use of tools and profit is 15 per cent. Gillette figures profit on the basis of 10 per cent. on the cost of material and 33½ per cent. on the cost of labor. This would probably average about 20 per cent. on the whole contract.

Contractors for municipal work are paid in cash or bonds. The occasions when they are paid in actual currency are so rare that they need not be discussed. These bonds are of two kinds: the municipal bond, guaranteed by the city or village as a whole; and the special assessment bond, issued by the city or village in anticipation of the collection of the tax upon each lot or parcel of land benefited by the proposed improvement. Here are two classes of bonds issued by the same city or village for the payment of the same class of work, each drawing 5 per cent. interest, each taken by the contractor at par, yet of very different market value.

The special assessment law of the state of Illinois is considered very much superior to the similar laws in Iowa, Wisconsin and Indiana, irrespective of the fact that where only 5 per cent. interest is paid in Illinois, 6 per cent. is paid in these other states. The special assessment bonds of these states readily sell for par, owing to the increased rate of return on the investment, and the public buys them for the reason of that particular attraction. The Illinois bonds assessed on relatively the same kinds of property are sold at a discount of from 5 to 10 cents on the dollar, in order to net an average of 6 per cent. or more for the time that they have to run.

Here, then, we see the property-holders paying nominally 5 per cent. on an inflated cost of an improvement according to the state law, but paying 6 per cent. or more on the actual cost. This difference of cost of the work, ordinarily termed discount, must be added to the engineer's estimate as a part of the cost of an improvement. This discount is not always 5 per cent., but varies as the money market changes. When money is plentiful, bonds can be marketed at 95, but during the last year many have sold for less, if they could be sold at all.

Special assessments are levied against every lot or parcel of land benefited by the improvement, according to such benefits, and the assessment must be equitable. The amounts so assessed are spread irrespective of the value of the lot or the owner thereof. If the property assessed is improved, the value is greater and the security behind the bond is increased. If the property is vacant and poor in value, it has a tendency to decrease the security of the bond, unless it is so located that its improvement or the growth of adjoining property enhances its value.

Again, many assessments are spread against property which has been sold for taxes and been forfeited to the state. In this case, the state pays no special assessments. Hence, in looking over proposed improvements, before the letting, the contractor usually examines the assessment and if he finds property forfeited to the state it reduces the amount available for the construction of the improvement by the total amount of the forfeitures. If the estimate, after taking off the forfeitures, is too low to do the work, the contractor either must not bid at all or else must bid above the estimate. From these facts it follows that it should be the duty of the engineer to look over property before making his estimate, to ascertain its condition, and make his estimates accordingly.

The Value of Bonds

The first duty of the contractor, when he receives bonds for work, is to see that they are good. He must depend upon the expert attorney to advise him. But such advice, however favorable, will not force a property holder to pay his tax for an improvement, nor will it force the state to pay a tax upon a lot which has been forfeited to the state for non-payment of taxes. No special assessment bond becomes forfeited if every lot or parcel of land pays its tax. If property that is assessed for special assessment improvements is clear as to title and is worth as much or more than the assessment, there is not much doubt of the assessment being paid. It is this doubt or possible chance of a forfeiture that bankers and bond-buyers shy away from. They use it as a club to force the contractor to sell his bonds at their price. After having the opinion of the expert and of their own legal talent as well, they send representatives to look over the property assessed, and if there is no possible chance of a loss, the contractor may be offered 95 per cent., if 30 per cent. of the property is vacant, 92 per cent. If there is a forfeited lot, he will get no offer at all.

I am going to suggest two remedies that I am positive, if made law, would have a good effect on the market value of these bonds. As they depend upon the engineer's estimate they may properly be included here.

First, the engineer's estimate should be ample; enough so that after paying the contract and the 6 per cent. allowed by law for the expenses of making the assessment, court costs, etc., there would be left a residue. Our present law requires that after the cost of an improvement is determined, the residue shall be rebated to the property holders before they pay their assessments. They pay only what is actually required.

My suggestion is that no rebate shall be made until the final bond is paid. I contend that if the property owner elects to take five or ten years to pay his debt, he should pay all expenses connected with it. I contend that the contractor should not assume the collection nor stand the responsibility of the non-collection of special assessments. If there were a residue or reserve left in the special assessment fund, over and above the obligation or requirements of that assessment, it would undoubtedly go far as a guarantee toward insuring the full payment of every bond and the interest thereon, in case of a possible default in the payment of some installment.

Secondly, 6 per cent. is allowed by law to reimburse general fund accounts for cash advanced on account of the expenses of levying all assessments, and this 6 per cent. is always drawn from the first installment. Thereafter there is no fund to pay any expenses which may develop on account of the special assessment. If some of the property holders pay their assessment in full, the interest stops on their portion but the bonds continue to run until called. Here is a loss of interest and no fund to pay it. There might be a default on some payment of an assessment and no fund to pay it. The bonds are obligations of all the property holders, and inasmuch as the state has seen fit to assess them 6 per cent. for the making of an assessment, I can see no valid reason why another assessment of, say, 5 per cent., should not be levied and held as a sinking fund or reserve to pay the loss of interest and forfeiture, if any, and at the final payment of the last bond to be rebated to the property holders.

The assessing and creation of this reserve will, in my opinion, bring the value of special assessment bonds to a higher plane as marketable and investment securities. Contractors who, in bidding heretofore have figured a return of 90 to 95 cents on the dollar, would, if these provisions were a law, be able to figure on the basis of nearly par. If the creation of this reserve acts as I think it will, I cannot see that the property holder eventually pays any more than he does at the present time. What he now pays for as discount will be offset by the increased value of the bond.

The present state law requires that interest shall be paid upon all of an assessment except improvements put in upon the one-year plan. There are a great many such improvements, so small in total amount as to dollars and cents that it is impossible to make them in five or ten installments, where each installment must be a multiple of $100. Very often these improvements are put in in the early part of the season or late in the fall, and in either case the contractor must wait a year or year and a half for his money without interest. I believe the laws should be amended so that this kind of paper would bear interest, putting it in the marketable class of securities.

There seems to be a dark cloud in our special assessment law in regard to interest on the first installment where there are deferred installments. The ordinance usually sets forth that all installments except the first shall draw interest at the rate of 5 per cent., yet all municipalities collect the interest on the first as well as on successive installments.

Some municipalities issue vouchers on the first installment which bear no interest, but more of them issue those bearing interest. The former apparently have the law with them; the latter do it because they think it fair and honest, believing that as long as they collect the interest on the installment they should in turn pay it out on the voucher or bond. The special assessment law should be so amended that all installments shall bear interest and that all vouchers issued against the first or succeeding installments shall draw interest.

Summing up, an engineer's estimate, to be fair-conservative and reasonable, must be based on the following:

1. The actual cost of material and labor.
2. Contingent costs, amounting to from 10 to 15 per cent. of the above.
3. Contractor's profit, amounting to from 10 to 30 per cent. of the first two items. This will vary according to whether the contract is hazardous and difficult, requiring a large amount of special equipment, or whether it is comparatively easy, requiring but little equipment.
4. Allowance for converting the bonds into cash, amounting to at least 10 per cent. of the total amount of the contract.

Immediately after the close of the Sixth National Conference on City Planning held at Toronto last month, the Executive Committee decided that active and systematic investigations along the following lines should be pushed during the year, in preparation for the next conference: (1) To obtain reliable and comparable data for determining the effective size and distribution of playgrounds and the kindred recreation facilities; (2) To secure the drafting of a comprehensive outline of the powers, duties and administrative procedure in matters of town planning best calculated to serve the interests of the community, with a broad regard for the personal and property interests of the individuals; (3) To assemble data and define principles in regard to the design of subdivisions with a view to the most effective utilization of private property. These lines of work will be pursued under small committees who will endeavor to secure the opinion of every member of the Conference who will co-operate. The chairman of the Executive Committee is Mr. Frederick L. Olmsted, Brookline, Mass. The secretary of the Conference is Mr. Flavel Shurtleff, Boston, Mass.

An ambitious scheme for giving terminal facilities in Montreal is planned, and a public appeal has been made for British capital by the Montreal Central Terminal Company. The object of the plan is to give additional means of access to the south shore from Montreal, and to supply facilities for the exchange of traffic between the railways. It is proposed to construct railway lines, bridges, and tunnels and freight and passenger stations, involving the building of fifty miles of line. The work is to be carried out in sections, the first to provide facilities for the railways coming into the city from the north and west, while at the same time it is intended to proceed with the tunnel under the River St. Lawrence and the connections with the railways from the south and east.

Wooden forms for concrete were used fifteen or twenty times by the E. E. Smith Company, contractor for two sections of the four-track subway in Brooklyn. They were easily removable in panels, and in cold weather were washed with hot water immediately before placing the concrete. All of the cross bracing was set so as to serve for bracing the forms as well as the outside sheeting, and the upper transverse braces were cambered parallel with the cross-section of the roadway.

The Engineering Activities of the City of Edmonton, Alta.

(Staff Article)

MUNICIPAL engineering development at Edmonton has continued apace during the last few years. This is in general keeping with the spectacular growth of the city, which only received its charter ten years ago and whose population has increased from 21,000 in 1909 to upwards of 70,000 to-day. In 1890 the city of Edmonton was nothing but a small trading post and in 1900 the population was only 2,500.

As an instance of the important place that Edmonton is taking among the constructional centres of the Dominion, it may be of interest to mention the fact that the estimate of building work to be carried out this year is ten million dollars—rather more than four times the actual value of the building work done in 1909.

Edmonton—Outlet 10′ 6″ sewer, showing overflow.

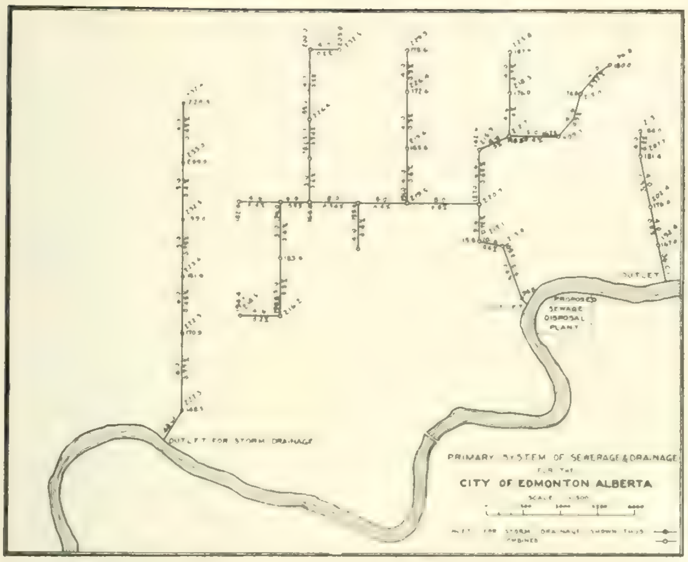
A condensed statement of Edmonton's engineering activities was published in our issue of May 27 last, in Part III of "Canadian Constructional Centres." In the present article, thanks to the co-operation of the City Engineer, Mr. A. J. Latornell, mention of whom is made in the personal column of this issue, we are enabled to give some further interesting details concerning the work and administration of the Engineering Department.

SEWERAGE AND DRAINAGE

There are one hundred and twenty miles of sewers in the city, varying from 8-in. to 10-ft. 6-in. The extensions planned for the present year comprise a total of approximately forty miles, at an estimated cost of $2,000,000. The materials used in sewer construction are vitrified tile pipe up to and including 24-inch and above this size, brick, plain and reinforced concrete, with vitrified segment blocks.

The trunk system now under construction is being built entirely in tunnel, varying in depth from 40 ft. to 100 ft. below the ground surface. The plateau on which the greater part of the city of Edmonton is built is situated 160 to 200 feet above the waters of the Saskatchewan River, into which the tunnel system discharges through the 10 ft. 6 in. sewer. The form of sewer used in this tunnel was designed by Mr. Alexander Potter, consulting engineer, New York City, whose article, "Sewerage and Drainage Improvements at Edmonton," was an interesting contribution to the April 30, 1913, issue of this journal. The sewer is constructed of concrete blocks, manufactured on the surface, the mix used being 1:2:3. Around the outside of these blocks when built into the sewer is placed a steel band. This band is in two pieces, the ends being drawn together by means of coupling shoes, which permit the band to be drawn up tight around the blocks. One of these bands is used for each ring of blocks, thus giving a band spacing of one foot centre to centre. Around the outside of these blocks and bands is placed about 4-in. of concrete, which serves to cover and protect the bands, as well as to fill the spacing between the outside of the blocks and the earth walls. The lower half of this envelope of concrete is placed prior to

Edmonton—C. P. R. high level bridge.


OUTLET FOR STORM DRAINAGE
OUTLET
PROPOSED SEWAGE DISPOSAL PLANT
PRIMARY SYSTEM OF SEWERAGE & DRAINAGE FOR THE CITY OF EDMONTON ALBERTA

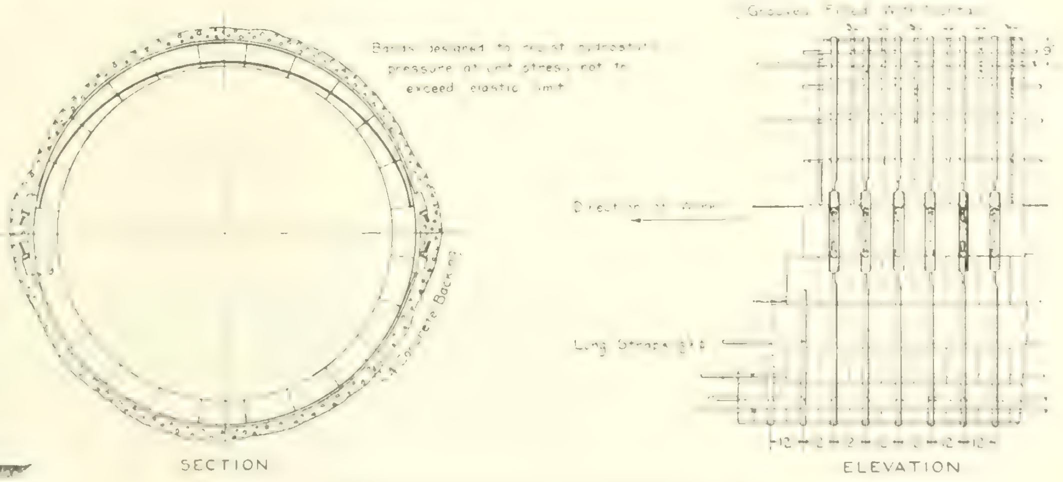
Details of Sewerage and Drainage Improvements at Edmonton, Alta.

the blocks, whereas the top half is deposited after the blocks have been placed.

Steel reinforcement is also used in the joints between the blocks. The hooping bands are designed to resist an internal or bursting pressure equal to the depth of the sewer below the surface without stressing the steel beyond the elastic limit. Already about eight miles of this type of sewer have been constructed and the results have fully justified the design.

The material through which the tunnel has been driven is for the most part a gray clay, blasting being necessary for its removal. The finished sewer follows up as fast as the excavation is done, so that in the class of material encountered practically no timbering is required. An electric hoist for hoisting material to the surface and lowering material for the construction of the sewer is used throughout the work.

The sewerage system is a combined system as far west as Twenty-First Street. West of this, the separate system is used, the sanitary sewage being carried eastward by sanitary trunks and dropped into the tunnel trunks described above. Although collected in purely sanitary sewers, it is discharged into the tunnel trunks and mixed with the combined sewage and storm water of the main system. The reason for this is to avoid carrying the storm water of the western district such a long distance eastward with the resulting large increase in the size of the tunnel trunks.



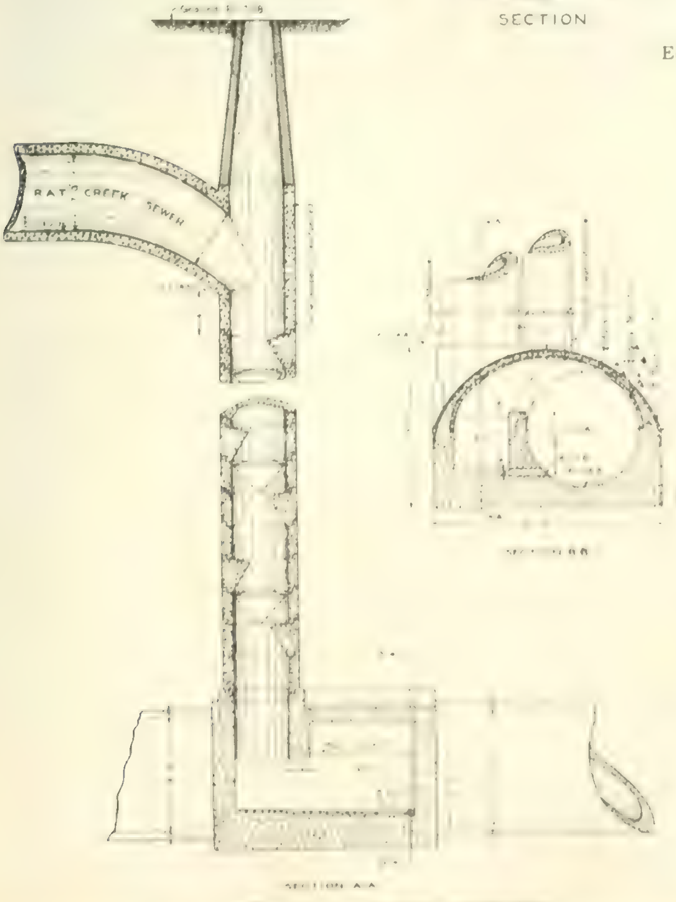
Edmonton—Typical sewer construction in tunnel

As the waterworks intake is east of Twenty-First Street, the usual method of separating the storm water from the combined system by providing an over-flow could not be used—hence the storm water west of this street required to be collected in a separate system of pipes.

The water and sewer pipes over a greater part of the territory are laid in the lanes. These lanes are 20 feet wide, and the sub-division provide fairly complete system of lanes, so that it is possible to make use of these for the installation of practically all the utilities. This leaves many of the streets with no underground work. This should materially increase the permanency of the surface work.

SEWAGE DISPOSAL

Very little other than the preliminary work leading towards sewage disposal has as yet been done. The preliminary work consists of concentrating the sewage at as few outlets as possible and acquiring the land necessary for disposal works at the point of outfall.



Edmonton—Typical drop manhole construction

Distribution of Local Improvements at Edmonton, 1900—1913

Year	PAVING Constructed Sq. Yds.	Miles	Existing Sq. Yds.	Miles	CONCRETE WALK Constructed Sq. Yds.	Miles	Existing Sq. Yds.	Miles	PLANK WALK Const'd Miles	Exist'g Miles	GRADING Const'd Miles	BOULEVARDS Const'd Miles	Exist'g Miles	SEWER Const'd Miles	Exist'g Miles	WATER Const'd Miles	Exist'g Miles	TELEPHONE Miles
1900			...	...	...	...	...	...			No Record						—	—
1901	...	...	...	...	...	...	...	...	1.0	...	No Record							
1902	...	...	...	...	...	...	...	...	2.4	...	Expended $457.35				—	—	—	
1903	...	...	...	...	...	...	...	...	6.5	...	Expended $222.14	..						
1904	...	...	...	...	227.00	.04	227.00	.04	6.92	...	.50	...	.	.		.	.	
1905	...	...	...	...	10,105.00	1.50	10,332.00	1.54	7.75	...	3.80	...	...	—	...	—	—	—
1906	...	...	...	...	15,840.00	2.38	26,172.00	3.92	8.00	33.0	6.09	2.750	2.750	2.70	10.90	4.00	13.88	
1907	40,967.70	1.210	40,967.70	1.210	10,584.00	1.68	36,756.00	5.60	9.30	36.0	1.60	.580	3.330	11.37	13.60	14.42	32.30	1.58
1908	63,048.30	1.700	104,016.00	2.910	6,373.17	1.05	43,129.17	6.65	9.03	44.1	1.10	.845	4.175	9.13	24.97	7.54	39.84	.55
1909	45,969.40	1.179	149,985.40	4.089	1,390.40	.323	44,519.57	6.973	9.90	54.5	18.50	3.668	7.848	7.77	34.10	10.45	50.29	.50
1910	38,449.90	1.038	188,435.30	5.127	327.00	.09	44,846.57	7.063	5.90	60.0	7.53	1.752	9.595	3.94	41.87	4.72	55.01	1.50
														Scona	17.83			
1911	67,304.12	2.488	255,739.42	7.615	30,564.00	6.32	75,410.57	13.383	30.80	90.0	46.07	5.252	14.847	4.93	45.81	5.69	60.70	.50
1912	249,231.50	11.770	504,970.92	19.385	49,427.20	10.998	124,837.77	24.381	15.67	101.0	4.00	5.758	20.605	13.39	81.96	36.00	96.70	4.80
1913	441,497.55	22.231	943,700.67	41.556	44,837.10	11.037	168,710.87	35.270	16.93	113.0	10.63	9.132	29.177	30.34	112.30	31.90	128.60	10.00
Totals	946,468.47	41.616	943,700.67	41.556	169,674.87	35.418	168,710.87	35.270	130.10	113.0	99.82	29.740	29.177	83.57	112.30	114.72	128.60	19.23

One of the present outlets discharges into a septic tank constructed some years ago, but the balance of the plant has not yet been completed. It is proposed to instal a plant at one of the smaller outlets this year. This will consist of Imhoff tanks and, for the present, sterilization of the effluent.

ROADWAYS

The table submitted gives the comparative growth of street improvements in the last nine or ten years. It will be noted that in 1913 these were: paving, 22.231 miles; concrete walks, 11.037 miles; plank walks, 16.93 miles; grading, 10.63 miles; boulevarding, 9.132 miles. The work contemplated for the present season will amount to an expenditure of from one and one-half million to two million dollars.

In designing a street improvement one of the first questions to be decided, and one which is very difficult to settle, is that of the cross-section of the street. The total width of the street is usually settled by the subdividing. The problem of the proper cross-section of the street involves a forecast of the probable use of such street, and the varying uses to which it will be devoted, and that portion of the street that should be set aside for each class of traffic. Owing to the constantly changing conditions and the various stages that a street often undergoes, passing from residential to retail business, the engineer in deciding a cross-section should plan so that a street may be converted readily from one cross-section to another at some future time with minimum alterations.

For example, taking a wholesale section, the gutter is placed at the same distance from the property line as the curb line of a retail street; then by removing the curb and paving up to the property line, the retail street is converted into a wholesale street, the walks being placed in the centre. In the same way a wholesale street could be converted into a retail street. On a boulevarded street, the outer edge of the concrete sidewalks is placed just 6 ins. back of the curb line on a business street of the same width. Should it be desirable to convert this boulevarded street into a business street, this 6 ins. is taken up by the curb of the pavement.

WATERWORKS

The water supply is taken from the North Saskatchewan River, the water being pumped by low lift centrifugal pumps to the sedimentation basin and thence through gravity mechanical filters to the Filter Water Reservoir. After being treated with hypochlorite of lime, the water is pumped by the service pumps into the distribution system. The distribution system consists of 128.6 miles of pipe, varying in size from 4 ins. to 20 ins. The pressure of the distribution system is maintained directly from the pumps. These are capable of giving the necessary increased pressure required for fire purposes—although the Fire Department is equipped with motor-driven fire pumps.

STREET RAILWAY TRACK CONSTRUCTION

The street railway system, like all the other utilities, is municipally-owned. During the year 1913 a large programme of permanent track construction was carried out. The design of the permanent track construction was completely changed from that previously used. Instead of the girder type of construction, that is a construction using a concrete beam running under the rail as its support, a 6-in. concrete slab was laid across the street railway allowance. The skeleton track was then laid upon this, wooden ties being used underneath the rails. The rails and ties were then concreted in with a concrete filler and pavement surface laid on top.

Owing to the almost prohibitive cost of granite sets or other similar material, a paving between the gauge line of the rails was made of 4-in. reinforced concrete slab. It is expected that this will give fair service, owing to the generous width of the streets of this city, which does not necessitate the same use of the car track space as if these streets were narrower.

C. P. R. ENTRANCE

Practically all the structures required to separate the grades of the C. P. R. entrance from the city street grades have been completed. This work involved the construction of subways at Saskatchewan Avenue and Jasper Avenue, with overhead bridges at McKay Avenue and Victoria Avenue.

At Saskatchewan Avenue the steam tracks are carried on a high fill, making the construction of a grade separation at this point very simple and with comparatively little damage to the abutting property. In this case abutments were placed at each property line upon which was placed a through plate girder structure carrying the steam rails over the roadway. The approaching grade from the west is 4.5 per cent, while the approaching grade from the east is practically level.

Edmonton—Jasper Avenue Subway.

On McKay Avenue the grade separation is made by a bridge over the tracks. At this point the steam tracks are in a cut of 12 feet, which brings the top of the bridge 13 feet above the general ground elevation. The bridge structure itself is made up of reinforced concrete having approaching grades of 4.75 per cent from the west and 5.5 per cent from the east. Provision has been made for a double line of car tracks in the centre of the 40-foot roadway, with two 5-foot concrete walks, one on each side.

On Victoria Avenue the grade separation is made by a reinforced concrete bridge similar to that on McKay Avenue. The approaching grades in this case are somewhat steeper than they are on the other bridge, being 6.5 per cent on the west approach and 8 per cent on the east approach. The roadway is made 30 feet wide with 5-foot sidewalks on each side.

On Jasper Avenue the steam railway crossing is at an elevation of 4 feet above the original elevation of the street. This made it necessary to depress the roadway into a cut of 13 feet. In approaching the crossing from the east, the descent is on a 5.5 per cent grade, while the approach from the west is much lighter, it being only 1.6 per cent.

The construction of the subway itself was carried out by the C. P. R., but the construction of the street railway tracks and the paving base was carried out by the City Construction Department.

In laying down the general policy for the subway construction it was decided to eliminate as much of the retaining wall construction as possible, in order that business buildings might be built almost up to the subway structure itself. If this object can be accomplished it will practically eliminate the appearance of a subway, especially when the subway zone has been built up with business houses.

Advantages of Brick Paving

THE adaptability of brick to rural highway construction was the subject of an elaborate exhibit at the recent International Roads Congress held in Montreal. Many Dominion cities are large users of brick for urban pavement, but the country road of brick is a comparative novelty in Canada. However, its rapid rise to favor in parts of the United States has attracted attention and visits from many Canadian highway engineers. The vicinity of Buffalo and Cuyahoga County, Ohio, which contains Cleveland, are the leading brick road localities of the world.

The success of the brick road has been largely due to its permanence under the new conditions of power traffic which have played havoc with older types of road improvements. The hardness of brick enables it to withstand the friction and tear of the rapidly running automobile. This quality so appealed to Governor Glynn, of New York state, that he recently devoted an entire message to the legislature on the advocacy of brick for all main highways in the state of New York. Cuyahoga County, Ohio, has nearly 400 miles of this type of rural road, built at an approximate cost of $1,000 per mile for each foot in width. One effect of these roads has been such a rapid rise in rural land values in the county that their increased tax valuation has more than covered the cost of construction.

Edmonton—Saskatchewan Avenue Subway.

Such roads have won their way to the appreciation of auto owners and farmers alike, being equally passable in any season of the year and so drained that every rain washes them clean. Where other types of road require constant vigilance and constant expense for maintenance, a properly constructed brick pavement, according to government authorities in the States, has never yet been known to wear out

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In the progress article descriptive of the Methodist Book and Publishing House, Toronto, which appeared in the Contract Record of June 10, we inadvertently omitted to state that the steel frame construction was designed by Messrs. Harkness & Oxley, Consulting Engineers, Toronto.

Construction of the Klondike Pipe Line

Engineering Difficulties Arising Out of Severe Climatic and Other Conditions and the Methods by Which They Were Overcome

By W. W. Edwards

THE Klondike pipe line was built during 1907 and 1908 by the Yukon Gold Company, at Dawson, Yukon Territory. It is an inverted siphon crossing the Klondike River Valley, and was designed for a capacity of 125 sec.-ft., which figure, however, has been slightly exceeded in operation. The maximum head on the pipe line is about 1,100 ft. The total length of 15,760 ft. is made up of: 2,390 ft. of wood stave pipe, 49-ins. inside diameter; 5,850 ft. of rivetted steel pipe, 49-ins. inside diameter; and 7,520 ft. of lap-welded steel pipe, 43-ins. inside diameter. The steel pipe ranged in thickness from 3/16 to 11/16-in., and came in lengths of from 15 to 30 ft. It is the largest of several inverted siphons along the line of the Main Ditch System of the Yukon Gold Company, 70 miles in length, which supplies water for hydraulic mining operations on Bonanza Creek, near Dawson.

The location of the pipe line was determined chiefly by two conditions: It was necessary to cross the valley below the junction of Bear Creek, and also to keep above the dredging ground of the Canadian Klondike Mining Company. These two determining features left little room for adjusting the line to fit the ground conditions, but it is probable that the location adopted was as good as could be obtained in any case.

The intake end of the pipe is on a comparatively steep side hill. This hill is of decomposed schist covered by a foot or two of soil which supports a growth of bushes, poplars and a few spruce trees. The flat valley of the Klondike is here about 5,000 ft. wide. It is covered with a blanket of Arctic moss from 1 to 2 ft. in depth. Below this there is a layer of frozen "muck," or vegetable mould, which is generally about 5 ft. thick, and below this is generally found gravel. This formation is peculiar to the North, and will warrant a little explanation. The frozen "muck," or "frost," as it is sometimes called, is made up of decomposed roots, moss, tree branches, etc., mixed with some little rock and sand, and the whole mass is frozen solid. The moss blanket on the surface protects it from the summer heat, and whenever this blanket is undisturbed the ground beneath the moss remains frozen the year round. If the moss covering is removed, however, allowing air and water to act on the frozen muck, it soon melts. This condition may be found in almost every river valley in the far north, as well as on the sheltered hill slopes. In places the "frost" has been built up by the seasonal thaw not penetrating fully through the winter's freezing, and extends to a known depth of 200 ft. and unknown further depths. This condition makes the question of foundations quite serious. The "frost" is a good foundation if it is not disturbed, but, if disturbed, the structure placed in it must be frozen in and the surface mossed over again to keep out the air and water absolutely. If this cannot be done, the structure must be carried through the frozen muck to good gravel or bed-rock foundation. Frozen muck was encountered all the way across the Klondike Valley and in spots along the pipe up the sidehill as far as the discharge box.

Only two horizontal angles were made in the pipe line, with the exception of those used in making a short offset around the base of a hill. Manholes, drains, and air-cocks were provided wherever necessary. Cast steel expansion joints were put in every 500 ft. to allow for the expansion and contraction due to the extreme variation in temperature, from 80 deg. F. in summer to —70 deg. F. in winter. One three-span steel bridge, 295 ft. long, was necessary in crossing the Klondike River, and a total of several hundred feet of pile trestle or framed trestle were put in at various places along the line. The aim was to have the pipe supported at least once in every 16 ft. Whenever the conditions warranted it, as for instance, when good foundation was deep, trestle bents were built every 32 ft. and kingpost trusses were put in to give the intermediate bearing. In good material, sills were merely laid in the bottom of the pipe trench and on these the pipe was supported. Whenever the foundation was within 3 or 4 ft. of the pipe, crib supports were used; if greater than 4 ft., framed bents were used.

One anchor was put in at least every 500 ft., about midway between expansion joints, and, when necessary, they were used more frequently. Each anchor consisted of a cable wrapped around the pipe in the form of a clove hitch, the ends being made fast to two "deadmen" on opposite sides of the pipe. Each "deadman" was set in the ground about 6 ft. below the surface.

On the side-hills drains were dug at frequent intervals to lead off seepage and leakage. At every drain a bulkhead was put in which fitted closely to the pipe and effectually intercepted the water.

In many ways conditions were unique for heavy construction. Common labor was paid $4 per day and board. The working season was short, being limited to five months—May 1 to October 1. Some kinds of equipment were plentiful in the country, notably steam engines and boilers, but in other lines it was sadly lacking. A well selected stock of equipment was ordered for the job, but breakages and unforeseen difficulties sometimes caused awkward situations, in view of the distance from a base of supplies.

Power was furnished from the Yukon Gold Company's hydro-electric plant on Little Twelve Mile River, about 50 miles from the pipe line. It was delivered at the main transformer house at 33,000 volts, and there stepped down to 2,300 volts. From there it was distributed at this voltage to the transformer banks at the several compressors and at the machine shop, where it was stepped down to 220 volts.

Construction was begun in 1907. The right of way was cleared and a small quantity of pipe trench was dug. The three-span steel bridge over the Klondike was erected. Foundation cribs were put in the river bed, the work being done mostly while the river was frozen over and the water low. Piles were driven in the river bottom and sawed off at the gravel surface, and on them the cribs were built. These cribs were then extended to a height of about 5 ft. above high-water level and filled with rock. They were sheathed with sheet iron on the up-stream end to protect them from ice. Derricks were used in assembling the steel spans. During this season, also, a pile approach to the bridge, 400 ft. long, was built, and several other smaller pile trestles and framed trestles. Construction was halted in the midst of the working season in 1907.

In the spring of 1908 construction was begun again. It was desired to have the job completed by the following October 1, the end of the working season. All the pipe was not then on the ground, and what was on hand was not continuous. That is, sections of pipe were missing here and there. As there were so many different kinds of pipe in this line, and as extra pieces were few, it was generally impossible to use sections of pipe interchangeably, therefore work could be started only at certain places. In the course of the work, it was necessary to start laying pipe at four different stations. An error in surveying would lead to awkward consequences where any of these headings joined, as well as at angle points in the pipe line. As there was no heavy machinery or plate for making pipe of this size in the country, and there would not be time to send "outside" for extras, it was necessary to be very careful in surveying.

All the pipe on hand was first measured up carefully and a relation established between actual measurements and those given on the blue prints. An offset line was then run paralleling the located line at a distance of 20 ft. As the seasonal thaw had loosened the original hubs so much that they could not be relied on, measurements were begun from a point on one of the bridge piers. Hubs were driven about 99 ft. apart, and measurements were taken from plumb-bob strings held from tripods. This was done on the side-hills as well as the flats. A standard pull of 15 lbs. was used, the same as had been used in measuring up the pipe on hand. Corrections were made for temperature variations. Levels were run over the hubs, and horizontal distances were computed from the slope measurements and elevation differences. This system resulted in giving a first-class base line, which could be absolutely relied on in setting grades or starting points. Grades were "shot in" by transit. Points were set along the edge of the pipe trench, and were transferred to the bottom, when needed, by using a large wooden square and a carpenter's level. Bench-marks were set every 50 ft. in elevation. Levels were determined by running ahead for half a day and then tying back to the starting point.

In construction, it was frequently found advantageous to depart from the profile in order to avoid excessive excavation, and in these cases grade changes were made by shifting angle points.

Pipe was distributed along the line by a tramway. The cars were pulled by horses across the flat and by hoists on the hills. Of these hoists, two were run by steam, and one by electricity. Signals were given by use of a wire attached to a spring pole. A telephone system also helped in signalling and general communication. Turn-tables were installed on which to change the sections of pipe end for end when necessary. Steel-frame cars were used. In hoisting, a bridle was attached to the end of the pipe, and the cable was shackled to this bridle. When the pipe was at the spot desired, the cars were chained to the rail, and the pipe, with the hoisting cable still attached, was rolled into the ditch. This held the pipe from getting away on the side-hill, and the cable always had so much spring that no harm was done to the engine.

The fitting-up gang used ratchet jacks in fitting up the pipe. The section was first slid down to the last section already connected up and then turned until it was right side up. The "front," or free end, was then raised until the top holes at the back end could be caught by drift-pins to the last section. Guide-straps were then bolted on at the joint, and the front end was lowered gradually. As the front end came down, the joint was sledged and the guide-straps were tightened as necessary. When the joint was entered all around, a ratchet turnbuckle was attached and used to pull it together. Fitting-up bolts were put in every third or fourth rivet hole. Four or five sections of pipe per 10-hour shift was an average for the fitting-up gang.

Rivetting, caulking, and drilling were done with pneumatic tools. Air was furnished by 8 x 8-in. Clayton air compressors run by 15 h.p. 3-phase motors. One air compressor would furnish air enough to operate a rivetting hammer, caulking hammer, drills, and air dolly, with not much to spare. The compressor outfit were mounted on platforms and moved from place to place as desired. The rivetting of the holes in the

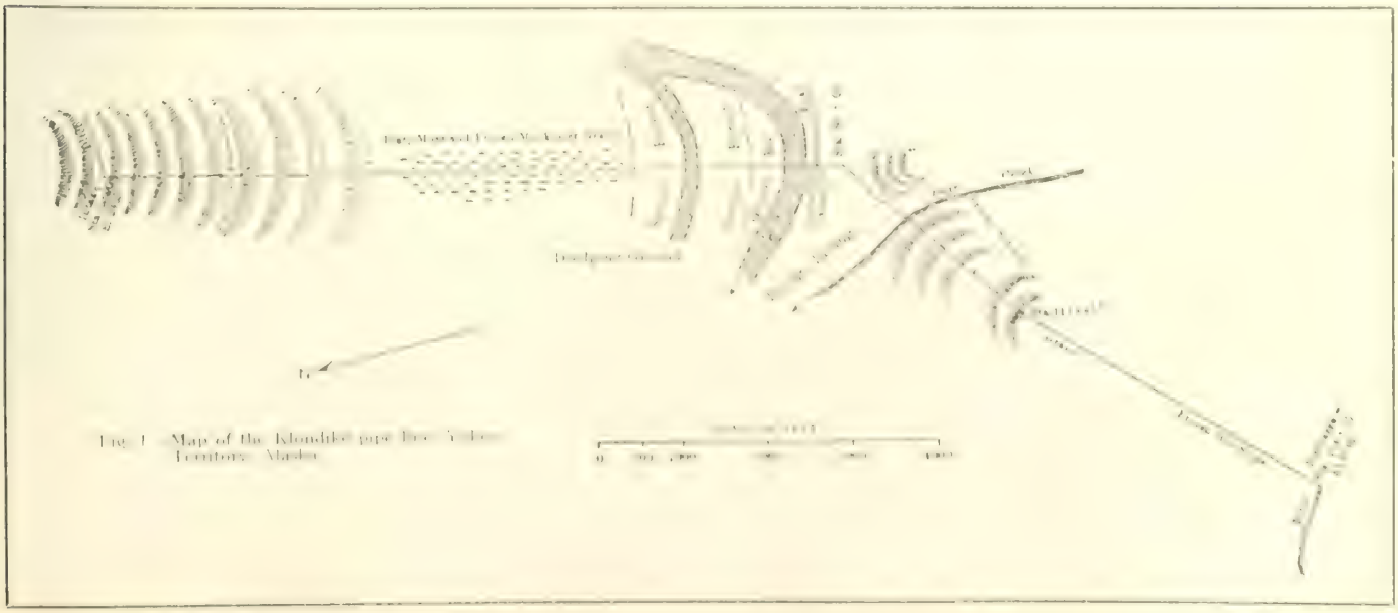


Fig. 1.—Map of the Klondike pipe line, Yukon Territory, Alaska.

bottom of the pipe was done from the inside, and of the upper holes from the outside. Air dollies were used in holding on inside the pipe and spring dollies on the outside. Each rivetting gang consisted of a riveter, bucker-up, heater, and passer. An average day's work was from 100 to 180 1-in. rivets, when conditions were good. Fitting-up bolts were used liberally, and the joint was well sledged before driving each rivet. All castings were hand-riveted to the pipe, the rivetting being done on the inside.

The expansion joint castings were frequently found to be too large for the pipe. In such cases the pipe was heated by a blast lamp and belled out with hammers to fit the casting. Rivet holes in all castings were drilled in the field after assembling. All caulking was done with rounded-edge fullers, the square tool being dispensed with. The rivetted pipe was caulked on the outside only, the lap-welded pipe was caulked both inside and outside. Rivets were inspected with a 1-lb. tapping hammer.

The pipe was coated on the outside with a red mineral linseed oil paint and inside with a quick-drying black paraffin paint.

The wood stave pipe was of California redwood staves thoroughly seasoned. It was laid in a trench 2 ft. deep, and, when completed, was back-filled to a depth of half the diameter of the pipe, so as to give a good bearing.

The intake penstock was equipped with overflow and turn-out, as was also the discharge box. The discharge box was located on a shaded side-hill on frozen clay. This condition made necessary considerable cribbing to protect it from the sloughing of the clay when it thawed consequent on the removal of its moss covering.

Timber was secured from adjoining leases and also from river drives. It was necessary to do considerable work to protect the river banks from undercutting in the vicinity of the bridge, as they were of loose gravel, loam and moss. Piles were driven and shear cribs put in along the river bank above the bridge. Protection cribs were also put in above the pile bents on the bridge to take the brunt of the ice pressure and to break up the ice stream.

Frozen muck, reaching to a depth of 45 ft., was encountered between Stations 84 and 90. Shafts were dug to gravel foundation and trestle bents were put in at intervals of 32 ft. Between Stations 90 and 93, a heavy cut through dredge tailings and solid rock was necessary. This was just at the base of a hill which was covered with frozen muck. The digging of this section was delayed until as late as possible so that the extreme cold would keep the overburden on the slope above from thawing on exposure, and consequent sliding.

A small spot of frozen clay was encountered at about Station 107, and the depth of good foundation being unknown, a corduroy of spruce trees was laid on the frozen clay in the bottom of the pipe trench and this was covered with about 2 ft. of gravel. A bulkhead was built around the pipe above this place to shut off all seepage and leakage, and a drain was run off to the side. The pipe was back-filled and the surface covered with moss again. Apparently, the foundation remained frozen, as no settlement was noticed.

Although work was begun at the camp about April 1, it was not until abuut May 15 that all the snow was off the ground and it was possible to work to the best advantage. A night shift was put on about May 15 and continued until October 1, by which date the pipe was all laid. The long days of the extreme northern latitude made lights unnecessary on the work until August 1. After that, a system of arc and incandescent lights was installed, which worked very well. The missing sections of pipe began to arrive about July 1, and from that time onward operations were rushed. A force of 350 men was used to push the work to completion. The different headings of pipe were connected up at the expansion joints. This was effected by sliding the outside ring of the expansion joint back on the pipe and then pulling it up to position after the pipe had been lined up.

A tabulation was made showing the space to be left open at the expansion joints at various temperatures, so that they would not close during the hottest or open in the coldest weather. This was followed in setting the joints. Gages were wired on at each expansion joint so that unequal expansion or contraction could be noted and steps taken to prevent it. The coupling bolts for each expansion joint were set so that the lap in each joint could not be less than 1-in. Reference points were also put in on each 500-ft. section of pipe, so that movement could be detected. Anchors were put in at every angle point. These were generally either bulkheads of timber against the pipe, used as thrust anchors, or cables around the pipe attached to "deadmen." When possible, at the angle points, a timber crib was put completely over the pipe and filled with rock. The high cost of transportation and the character of the foundation made concrete anchors out of the question. The only timber available was white spruce, which was soft and brittle, and had to be used with a high factor of safety in all structures.

Some trouble was experienced from the lap-welded pipe. Two makes were used on the job. One, an American make, was perfectly satisfactory, but the other, a German make, was not. One section of the second kind cracked along the weld for a distance of 10 ft. on being dropped into the pipe trench. This was patched and reinforced, and gave no trouble in operation. Another section of this pipe burst in testing under 835 ft. head. Examination showed a flaw in the metal. When it burst, the water was shot out to the side of the pipe line and little damage was done. This was the extent of the trouble with the line in testing.

In operation, the quantity of water flowing through the pipe fluctuated considerably. As the difference in elevation between intake and discharge was 195 ft., this variation caused great fluctuations in the water level in the pipe at the intake end, there being no regulating gate at the discharge end. When little water was flowing, it ran in a very rapid stream down the bottom of the wood stave pipe at the intake end. This had the result of rapidly wearing out the bottom staves, so that considerable patching had to be done.

Bulkheads were put in at each end of the pipe and all other openings were closed as soon as the pipe was thoroughly drained. Thus the air circulation inside the pipe was shut off and the subsequent snow formed a blanket which protected it from the extremes of the winter temperature. It was found that with an air temperature of —30 deg. or —40 deg. F. the temperature inside the pipe was only about —5 deg. F. In operation, the pipe is drained at the close of the working season, about October 1, and opened again about May 1.

The peculiar and therefore the most interesting feature of this work was, as noted before, the study of foundations and the best styles of substructures to be used in the frozen ground. In places in the North, piles of sawdust have been placed on the moss, and buildings put on this foundation. When water is kept away, this makes a very good foundation, as the saw-dust protects the moss and the frozen ground below from heat and consequent thawing, thus insuring stability. On this same principle, in running a road or railroad grade across frozen ground, it is best not to cut but rather to make fills on top of the moss. Thus, on a railroad grade near Nome, a fill was made of peat cut from the surface of the tundra. When dried out and packed this gave no more trouble—until it burned up—where as a cut in frozen ground is but an invitation to perpetual trouble from slides and settlement. In flume substructures, on the Yukon Gold Company's line, on frozen side-hills, cripple bents were tried and discarded in favor of level mudsills set in the "frost," about 2 or 3 ft. below the surface at the down-hill end. These were mossed over and remained frozen unless excessive leakage thawed the ground.

Mr. A. C. Strong, of the Yukon Gold Company, developed a type of structure which suited the foundation very well. He used piles driven into holes previously thawed out by steam points. The steam point is a strong pipe, at one end of which steam is introduced. The opposite end is rounded and a small hole left through which the steam may escape. This point is started into the frozen ground and is pounded down with a hammer as fast as it thaws through the "frost" in its way. These steam points were developed and used to considerable advantage in mining the frozen gravel. In substructure work, the steam point is used until the "frost" is thawed to the desired depth. It is then removed and a pile driven into the thawed-out hole. As the surface moss is disturbed hardly at all in this process, the pile immediately freezes in and remains in this condition. At last reports, pile substructures, such as these, were giving good service. This appears to be the cheapest form of substructure as yet devised for use in ground frozen to any considerable depth.

The foregoing work was done by day labor by the Yukon Gold Company, Mr. O. B. Perry, general manager; C. A. Thomas, M. Am. Soc. C. E., resident manager; H. H. Hall, Assoc. M. Am. Soc. C. E., superintendent of ditch construction, and in general charge of surveys; Mr. C. G. Newton, superintendent of pipe lines; and the writer, division engineer and general foreman.

Dry concrete, i.e., a mixture of aggregates and cement without water, should not be employed in laying concrete under water.

Builders' acid, which is equal parts of muriatic acid and water, will remove spots of mortar on brick or stone work, but is not the right materiai for cleaning stone that is begrimed from smoke and dirt. To accomplish this, apply to the surface, with a long-handled fibre brush, a strong solution of caustic soda or pearl ash. Let it remain on for about fifteen minutes, then wash several times with clear water, using a stiff brush or broom for the purpose. If this will not be effective enough, scrub the stone with a stiff fibre brush, using soft soap and concentrated lye and sand, allowing this to remain on the stone until nearly dry, then rinse with clear water, using a brush to remove the cleansing material.

Elevated Steel Water Tower at St. Thomas, Ontario

THERE has been completed recently at St. Thomas, Ont., what is claimed to be the largest elevated steel water tower in Canada. This elevated tank was installed by the Board of Water Commissioners of St. Thomas for the extension of the city water supply. The following figures furnish some idea of the exceptional proportions of the structure: capacity of tank, 500,000 Imperial gallons or 600,000 United States gallons; height to top of tank, 131 ft. 2¾ in.; diameter of tank, 46 ft.; height of shell, 37 ft. 3¾ in.

This tank is high enough to give an average pressure of about 48 lbs. per sq. in. in the mains at the tower site, with a possible minimum pressure of 35 lbs. and maximum of 56 lbs. per sq. in. The inlet and outlet pipe to this tank is of standard weight, 14-in. cast iron pipe. The pipe is protected from freezing by a wooden frost jacket having four thicknesses of lumber and building felt. The tank is kept full at all times by the use of a Golden-Anderson Controlling Altitude valve on the 14-in. inlet line. In addition to automatically keeping the tank full at all times this valve may be opened from the pumping station at any time by means of an electrical attachment.

The completed tower at St. Thomas.

Ready access to all parts of the structure is provided by means of a separate steel ladder as shown in the illustration. From the balcony a ladder reaches to the top of the cylinder. This ladder is attached to a trolley which permits it to revolve around the entire tank. In the same manner a revolving ladder is fastened to the heavy cast iron finial at the apex of the roof. This complete system of ladders makes repainting a simple matter, and permits of thorough inspection of the tank and tower at any time.

The twelve posts making up the tower are of built-up section consisting of two 15-in. channels weighing 50 lbs. per foot, with one cover plate which varies in thickness from 13-16-in. at the bottom to 7-16-in. at the top. The columns are laced on the other side, making a section which may be readily painted at any time.

The horizontal members in the tower are made of two 6-in. channels weighing 8 lbs. per foot. The rod bracing between columns varies from 1¾-in. rods at the top to 2-in. rods in the bottom panel. A heavy system of rod bracing is provided at each strut level to keep the vertical tower rigid under wind pressure. Clamps are provided about the wooden frost casing which take the stresses from these rods without in any way distorting the frost case.

The tank itself is made of ½-in. plate in the lower part of the cylinder and diminished to ¼-in. plate at the top. The bottom of the tank is made with double-lap rivetted joints, the metal being ⅜-in. thick at the connection to the cylinder and 7-16-in. thick at the extype bottom. At the connection of the posts to the tank a heavy structural steel balcony or walkway, 30 in. wide, of [illegible]-in. plate and having [illegible]-in. x 4-in. x [illegible]-in. and 4-in. x 3-in. x 5-16-in. angle stiffeners, is provided. The roof of the tank is made of [illegible]-in. steel plates, rivetted and caulked watertight. The roof is supported on 24 steel rafters which rivet rigidly to the tank shell. The roof projects beyond the tank far enough to carry all water well beyond the balcony.

The bottom of this tank is made to a special curvature used exclusively by the firm manufacturing this structure. The bottom in section is a three-centered curve, which connects to the vertical cylinder on a tangent to this curve. In this design there is no other stress transmitted to the cylinder than in the commonly used hemispherical design. The advantage of this bottom is that it is more shallow than a full hemisphere, the total depth being 18 ft. 2 in., while the hemisphere would be nearly five feet deeper. This particular curve is selected because it gives the greatest capacity for the amount of steel used and reduces the stresses in the bottom to a minimum; furthermore, it gives sufficient slope to the bottom that no sediment will remain in the tank. This type of bottom is used extensively in railroad work where it has been adopted as standard by several of the largest companies.

Each of the columns supporting this tank is anchored by means of two 1¼-in. anchor bolts to a massive block of concrete. The footings measure 5 ft. square at the top and extend to a depth of 4 ft. 9 in., where they are 11 ft. 6 in. wide by 13 ft. 6 in. long. Each foundation is surmounted with a finished block of concrete 4 feet square.

The requirements of the system were determined by the Board of Water Commissioners and incorporated by Mr. M. Ferguson, city engineer of St. Thomas, in a specification. The complete water tower, exclusive of foundations, was built for about $27,000. The design was submitted by the Pittsburgh-Des Moines Steel Company, of Pittsburgh, Pa., who manufactured and erected the structure.

Large Reinforced Concrete Pier at Halifax, N. S.

EMPLOYMENT of 24-in. piles 75 ft. long, with a specially designed pile driver to place them; use of a special cement with a minimum of alumina to resist the chemical action of sea water and a timber sheathing at the water line to protect the concrete from frost action; the casting of the diagonal brace piles with a camber of from 2 to 5½ in. to allow for the bending moment of the pile's own weight—these are among the features of the new pier 2 under construction for the Intercolonial Railway at Halifax, N.S.

General Features

The pier, which when completed will be 686 ft. long and 235 ft. wide, and will carry a shed 677 x 198½ ft., is the first of a series of four large piers proposed to replace four much smaller ones. The general plan shows the relative location of the old and new piers and their track connections. By this plan piers, 2, 4 and 5 would be removed and pier 3 would be lengthened and widened to form the new pier 3. Work on pier 2 was started in the fall of 1911, and when the 1913 season had closed all but 120 ft. of the pier had been built and a start had been made on the shed. The shed will be a two-storey structure, the lower floor being devoted to cargo and mail. The upper floor will be fitted up and used for a time for passengers and baggage, with the intention of subsequently changing it for freight use only.

Reinforced-concrete piles were selected as most suitable for the foundations. Borings showed solid rock at a depth varying from 52 to 68 ft., overlaid with from 2 to 12 ft. of hardpan and from 5 to 27 ft. of soft mud. This meant an average height of 75 ft. from rock to track level. The track level was fixed at 15 ft. 8 in. above extreme low water. Owing to the small height available above low water for diagonal transverse bracing, and the great depth from low water down to rock, it was thought that such a system of bracing would not greatly increase the stability of the pier and its ability to withstand shocks from vessels. It was, therefore, decided to use reinforced-concrete brace piles driven at an angle of 3 on 1. This is believed to be the first application of such a system of bracing to reinforced-concrete work. As a further means of stiffening the pier it was decided to make a bank of dredged material under the pier so as to increase the amount of material through which the piles would be driven.

Special Cement

Two causes militate against permanency of concrete in salt water in this latitude. One of these is frost action, the water absorbed by the concrete at high tide freezing at low tide and causing the surface to spall away between the tide levels. The other is chemical action, which takes place between certain salts, notably magnesium sulphate, and constituents of the cement. Investigations have shown that this magnesium sulphate reacts with the free lime liberated during the setting of the Portland cement to form calcium sulphate, which in turn reacts with the calcium aluminate of the cement to form a sulpho-aluminate of lime. This last substance swells considerably on hydration, thus disintegrating the concrete, and it is evident that the extent of the disintegration varies directly with the alumina present in the cement.

To resist this chemical action arrangements were made with the cement manufacturers to supply cement with a maximum of 6.3 per cent of alumina, which was the lowest they could produce. It was also decided to use proportions of 1:1½:3, so graded as to produce as dense and non-porous a concrete as possible.

To withstand frost action it was decided to sheathe all concrete within the ordinary tidal range with timber. In order that this timber might be durable it is creosoted, and to prevent chemical action between the creosote and the cement the surfaces of the planks are coated with pitch.

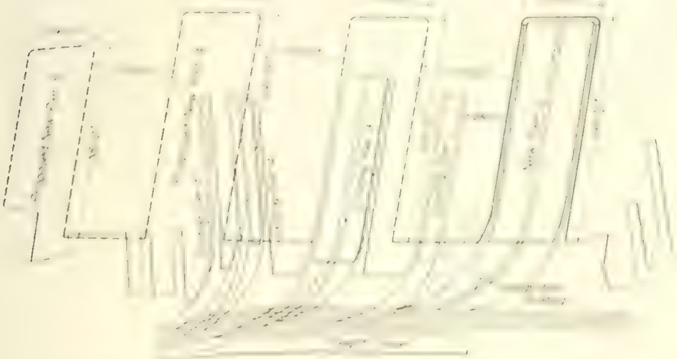
Loading

Live loads of 1,000 and 500 lb. per square foot for the first and second floors respectively were assumed in working out the details of design. The spacing of the piles was determined by the spacing of the shed column, which in turn governed the load for each pile to carry. As the drawings show, the transverse spacing of the columns is 39 ft. 6 in.; the longitudinal spacing of bents is 18 ft. Three vertical piles and one brace pile carry each interior column and single intermediate piles carry the floor. This arrangement gives a distributed load of 80 or 90 tons per pile. To keep the load on the rock well within a maximum of 35 tons per square foot the size of piles was fixed at 24 in. square.

Eight round rods, from 1 to 1¼ in. in diameter, according to the length of the pile, and laced every 12 in. with ¼-in. rods, form the reinforcing. This lacing is spaced closer at the heads of the piles, and at the tapered points additional rods and spiral hooping are used. The points are 3 in. square and are not shod. To facilitate bonding with the decks the rods are allowed to project 3 ft. beyond the head of the pile, and in each pile there is also set a staple, made from a 1¼-in. square bar 7 ft. long, to aid in handling.

Similar reinforcement is used in the brace piles, but in order that when the pile is built into the pier and subjected to an axial compressive load of 80 tons the stresses due to this load and the bending moment of the pile's own weight may be uniform it is cast with a slight camber. The amount of this camber varies from 2-in. for 45-ft. piles to nearly 5½-in. for the longest, which are 77 ft. The brace piles are driven in such positions that their heads can be built up along with the vertical piles under each shed column. In this way the full value of the pile is thought to be obtained without danger of its breaking up the decks.

A feature of the design of the shed is the use of expansion joints in the roof. Owing to the fact that only a part of the second floor will require heat, while the entire first floor and the baggage spaces which occupy the outer bays on each side of the upper floor for about five-sevenths of its length will not be heated, it was found necessary to provide these expansion joints to relieve the stresses that would be set up in the columns by the unequal heating of the building. Seven transverse joints are provided 90 ft. on centers. They extend over the interior bays only, and are formed simply by cutting the slab and leaving a ½-in. space, the longitudinal beams thus cut being designed as cantilevers on each side of the joint. A ½-in. steel plate laid horizontally and bedded into grooves in the adjacent edges of the slabs at each joint secures their alignment.

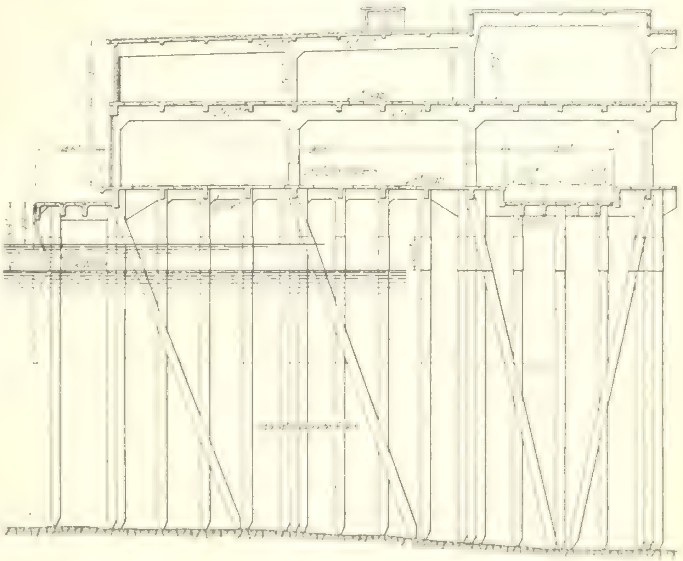


General plan of existing and proposed ultimate pier development

When the contract was let in September, 1911, work was at once started on the removal of the old piers occupying the site. This took all of the following winter, a diver being required to help remove many of the limnoria-eaten stumps of wooden piles. It might be mentioned that even creosote does not seem to be entirely effective in these waters, as piles treated with this preservative and driven about four years ago showed signs of attack.

Pile-Casting Yard

Meanwhile preparations were being made for casting the piles. At the east end of an area 800 x 600 ft. graded level for the purpose a gravel-excavating and concrete-mixing tower was erected. On this tower, which was about 92 ft. high and was carried on wheels so that it could travel north and south across the end of the yard, was placed the machinery for excavating, screening and crushing the gravel, mixing the concrete and conveying it by a cableway to the pile molds. At the top of the tower was a winch which operated a dragline bucket. This bucket emptied its contents of sand and gravel into the hopper. The material passed over a grizzly and all stones that did not pass through were conveyed to a jaw crusher. All of the material then went over 1-in. and ¼-in. screens. Material passing through the ¼-in. screen went into the separate sand bin. That which did not pass through the 1-in. screen was taken to a second crusher. Chutes from the sand and stone bins led to the mixer platform, wherein each batch was measured before being put into the mixer. Each batch of about 1 cu. yd. was discharged by means of a chute into a bottom-dump bucket which travelled along a cable stretched from the mixer tower to an anchor tower at the west end of the yard. This tower was also mounted on wheels and tracks and was moved along with the main tower.



Transverse half-section of pier and arrangement of batter piles.

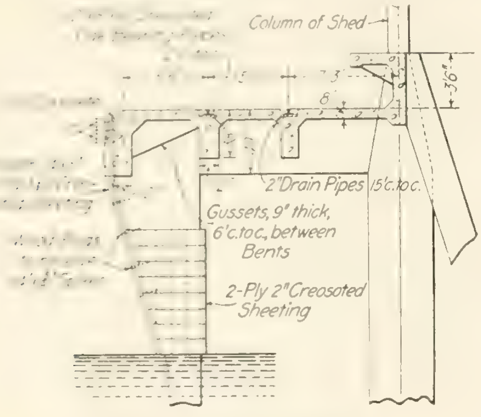
A timber pier 1,000 ft. long and 22 ft. wide, increasing in width to 38 ft. for 85 ft. at its outer end, was built for the landing of supplies and the shipping of the concrete piles. A 30-ton steam derrick at the outer end of the pier loads the piles on scows.

The pile yard was divided into ten sub-yards running north and south. The piles were cast, usually in pairs, with the axes east and west, parallel to the cableway. Transverse tracks ran between the piles and a longitudinal track ran the length of the yard on the outside. A locomotive crane handled the piles between the yard and cars on the transverse tracks, another transferred them to the longitudinal track, and the 30-ton steam derrick above mentioned disposed of them at the outer end of the pier. In handling these piles they were always supported one fifth of the distance from each end.

Simultaneously with these operations a special pile driver to place the piles was being designed and built. It took longer than was anticipated to build and fit up this pile driver, and it was not until January, 1913, that everything was in readiness for driving the piles.

Placing and Driving Piles

The method of placing and driving a pile was as follows: The driver was first placed in correct position by means of cross-ranges, and the three spuds were lowered to anchorage. The pile having been brought with others alongside on scows, straps were placed around it at points one-fifth of the distance from each end, and the pile was lifted in a horizontal position by one of the derricks and swung around in front of the driver so that the head lay at the bottom of the lead. The swinging of the derrick was accomplished by manipulating the forward spuds. The pile cable being made fast to the staple projecting from the pile head, the order to hoist was given, and as the derrick fall was lowered the pile was gradually hoisted into a vertical position, the derrick straps being disengaged as they slackened off. The leaders were then moved until the pile, hanging in them, was centered in exact position. Then the pile was lowered, its own weight being sufficient to penetrate the soft mud overlying the hardpan. When the thickness of the mud was equal to about a third of the length of the pile it was found that the piles would stand where placed without any bracing; as a rule, however, the pile was braced while the hammer was being adjusted on its head.


Column of Shed
3'6"
3"
8"
2"Drain Pipes 15'c.to c.
Gussets, 9" thick, 6'c.to c., between Bents
2-Ply 2"Creosoted Sheeting

Fender and other pier details.

Three separate cushions were used between the concrete of the pile and the ram of the hammer. On top of the pile was placed a 3-in. spruce plank. On this rested a cast-steel follower about 4 ft. high consisting of a hollow cylinder or post with top and bottom flanges. The bottom flange was flat, and in it were eight holes through which the projecting rods of the pile reinforcement passed and were protected. The top flange had cast on its upper side a rectangular depression in which was placed a hardwood block about 15 in. thick, bound round with a steel band. This block received the direct blows of the hammer and had to be frequently renewed; sometimes it would last for two piles only, while at other times it would stand the hammering of twenty. Usually the cause of failure was the breaking of the steel bands, but on one occasion the block was found to be on fire and badly charred owing to the heat generated by the force of the blows.

There were great differences in the amount of driving required. Where the quantity of hardpan was small the pile would often come to a stop after 200 or 300 strokes, while at other places nearly 1,800 blows would be required. The rate of penetration through the hardpan was small, the advance in the last strip being in many cases not more than ¼-in. per blow.

Little damage was done to the piles in driving. Only two out of 1,550 had their heads smashed, and these were among the first dozen driven, the cause being a continuation of the hammering after the pile had reached rock. No harm was done, however, by a few blows after the penetration had stopped. In order to find out what was happening to the point of the piles some of them were pulled out after having been driven to refusal. In only one case was there any damage done to the point, and this damage is believed to have been due to a sharp point of rock, which spalled off a small piece of concrete.

Usually about twelve piles were driven per ten-hour day, but when there were no delays as many as eighteen were placed.

Testing the Driven Piles

In order to test the bearing power of the piles after driving a load of 120 tons was supplied on the head of one of the piles and allowed to remain there for three hours. No settlement took place. The method of applying the load was as follows: The pile selected for the test was driven close to the cribwork bulkhead. Two 12 x 12-in. timbers were placed across the pile heads, bearing on a hardwood fulcrum. The inner ends of the timber were held down by a bracket firmly bolted to the base of the cribwork, and on their outer ends was placed the 16-ton steam hammer. The ratio between the outer and inner lever arms being 6½ to 1, the total load applied to the head of the pile was 120 tons. Other tests were made as the work proceeded, and in no case has any settlement of a pile been detected.

To get forms of the necessary strength on the short lengths of piles projecting above the water level, 4 x 8-in. horizontal walings were bolted on each side of the pile as soon after driving as possible, and on these rested the vertical forms for the building up of the pile to deck level. The bottom planks of the beams were carried on the pile extension form and were further supported by diagonal shores from the walings on the piles. Slight settlement of the forms took place on the pouring of the deck concrete, but in no case did any serious failure occur. It was found that by filling the pile extension molds at least twenty-four hours ahead of the pouring of the deck the settlement in the forms was reduced considerably.

Deck Joints

It was impossible to concrete such a large area of deck without having joints between different days' work. No joints, however, were allowed between beams and slabs. The beams having been designed as T-beams, the slab was always poured immediately after the filling of the beam supporting it. The joints at the end of a day's work were arranged so that the vertical face so made would be perpendicular to the compressive forces in the beam or slab at the joint, and they were made where the shearing stresses were a minimum. In the case of the longitudinal girders the joint had to be made at one side of the floorbeam carried by the girder, at a point where shearing stresses would occur. The joint here was made with a horizontal berm to give a bearing to the central portion of the girder, and care was taken to have some of the diagonal rods pass through the joints. For the deck the concrete proportions were 1:2:4, the stone being crushed gravel passed through a 1-in. screen. The concrete was mixed so that it would flow easily around the steel rods, but not so wet as to show an excess of water. Special care was taken to see that all steel was properly embedded in the concrete, and where there was any doubt of the concrete being able to work round the rod a batch of fine concrete, in which the stone was under ¼-in. in size, was used instead of the ordinary mixture.

About 120 ft., as previously stated, remained to be added when the work was shut down last winter. The temporary finishing off of the deck beams and slabs at this point has been so arranged that there will be no line of weakness when the pier is completed. This is being done by hooking all projecting reinforcing rods and by the addition of some special rods to take care of the continuous beam action. Beam seats have been built on the east side of the pile of the bent in question to carry the shore ends of the beams of the portion still to be built.

Personnel

The entire work is being done by the Nova Scotia Construction Company, of Sydney, N.S., under the management of Hamilton Lindsay, vice-president of the company. John Kennedy, consulting engineer, of Montreal, is the designer and chief engineer, and is represented on the work by A. F. Dyer, resident engineer. The major part of the foregoing article was prepared from a paper presented some time ago by Mr. Dyer to the Nova Scotia Society of Engineers, and rearranged by the Engineering Record.

Hydro-Electric Development at Cedars Rapids, Que.

Progress Report

THE progress of the hydro-electric plant now being constructed at Cedars, P.Q., on the north shore of the St. Lawrence, by Fraser, Brace & Company, for the Cedars Rapids Manufacturing & Power Company, is shown by the following figures of work completed:

	Aug. 23 1913	Dec. 1 1913	May 1 1914
Rock excavation	21%	25%	58%
Earth excavation other than stripping and trench work	[illegible]	60	[illegible]
Earth excavation in trenches and ditches, and stripping seats of banks	36	84	Complete
Transporting and placing excavated rock	20	18	62
Stone protection	[illegible]	[illegible]	[illegible]
Transporting and placing excavated earth	[illegible]	[illegible]	[illegible]
Concrete in power-house substructure	16	26	69

The present plans are for a development of 100,000 horse-power, with later an additional 60,000 horse-power. There are 1,500 men engaged in the work of construction, and about ten miles of temporary lines are laid for the purpose of transporting the material excavated from the canal, at the end of which is situated the power-house. The canal is a great undertaking, the excavated material being utilized to form the banks. When the work of earth removal is completed at the upper end of the canal, the equipment will be moved further down the canal to reinforce the working equipment at that point. In the south bank a concrete structure with gates constitutes a spillway and ice sluice. This will dispose of surface ice, the canal below it being further protected by booms.

The additional development will be on the north side of the present power-house. In the construction of this structure a large crane is used to convey buckets of concrete from trains, into the foundations over which it projects. The rock crushing, concrete and mixing plant is located considerably to the north of the power house, so that the progress of the work in either case is entirely independent of interference by the other. The power-house has ten tail-race openings, one for each unit, with three small openings for the exciter units. Work has now been started to bring the tail-race down to grade as some excavating still remains to be done. This work, however, involves nothing beyond straight disposal of excavated material.

Large cranes are used for handling the heavy parts of both water wheels and generator units now being installed. Tracks entering the building make it possible to move such trainloads of machinery almost to the identical spot of installation, the cover plate of each water wheel has a diameter of 20 feet and weighs about 120,000 lbs. The transformer-house is 800 feet distant from the north end of the power house, and later part of this will be utilized for the extension of the power-house. An erecting tower enables the concrete to be elevated and distributed, the concrete being placed at all points of the building by means of a chute.

The Unit Construction Company, of St. Louis, Mo., are constructing the power-house units and transformer-house superstructure. The Phoenix Bridge and Iron Works, Montreal, are supplying the structural steel work.

The company have let a contract to Simpson Brothers, Montreal, to dredge the material at the head of the canal and to dredge the forebay immediately above the intake. There is involved the removal of about 175,000 yards of material, and the work is to be completed before the end of the year.

The storms of last winter proved that concrete poles are far better than wooden ones for holding up telephone and telegraph wires. Not one concrete pole on the Pennsylvania system was blown down, although hundreds of wooden ones were broken.

One of the novel forms of entertainment at the recent convention of the American Society of Civil Engineers in Baltimore was a luncheon 71 ft. below the street surface in the 29-ft. Jones Falls diversion tunnel, the largest drainage tunnel in the world. Calvin W. Hendrick, chief engineer of the Baltimore Sewerage Commission, conceived the idea of the underground banquet. The floor of the tunnel had been covered by boards, and twenty tables were arranged for the guests.

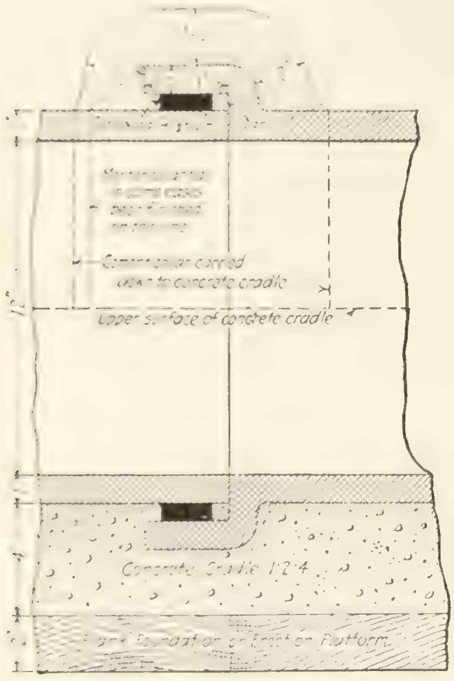
Water consumption in London, Ont., during 1913 was 92 Imp. gal. per capita, according to the last annual report of the water commissioners of that city. Figured on pumping station expense the cost was 16.6 cents per 1,000,000 Imp. gal and 6.9 per 1,000,000 gal. raised 1 ft. About 84 per cent of the pumping is done electrically. The services now number 13,978, of which 2,115 are metered. More than 450 meters were installed in 1913, against only 376 during the previous year.

Water-Tight Sewer-Pipe Joints

By E. J. Fort

THE drainage for several square miles of territory in the southern portion of Brooklyn, in the neighborhood of Coney Island, Sheepshead Bay, Jamaica Bay, etc., where surface elevations are low, provide for a separate system of sewers, in which, in most cases the sanitary sewers are below the level of ground water, and in all cases the domestic sewage must be pumped. This made the matter of water-tight pipe joints one of great importance.

At the beginning of this work, the Bureau of Sewers had had no experience in the use of the various compounds offered on the market for this purpose, and had little information in regard to their merits. It was thought best, therefore, to depend upon extreme care in the use of cement mortar with a hemp or oakum gasket for the desired results until the various compounds available could be thoroughly tested. The first few contracts let, therefore, provided for cement-mortar pipe joints. The mortar was mixed in the proportion of one to one and was liberally used. In most cases, where pipes have been laid below ground-water level, they have been laid in a concrete cradle, and where the pipe joint is not buried in the cradle it is inclosed in a cement collar at least 2-in. thick outside the bell. When the contractor and inspector can be relied upon for careful and conscientious work, a pipe joint made in this manner and allowed several hours to set before water is allowed to rise over it will be practically water-tight under heads of water as great as 8 ft. These individuals, however, cannot always be relied upon, and a very slight injury to a joint made in this manner will produce a leak.


Cement collar carried down to concrete cradle
Upper surface of concrete cradle
Concrete Cradle 1:2:4

Sewer-pipe joint made with a compound and protected by a cement-mortar collar

Use of a Compound for Joints

A compound suitable for sewer-pipe joints should possess the following properties:

(1) It should show no deterioration when submerged in either fresh or salt water or in alkaline or acid solutions of moderate strength. Domestic sewage usually has an alkaline reaction, but frequently in the neighborhood of factories it has an acid reaction. In certain places, ground water is heavily charged with alkali. The life of the sewers as water-tight structures will be measured by the life of the joints.

(2) It should melt and run freely at temperatures not greater than 250 deg. F. It should be poured at a temperature of approximately 400 deg. F. to make certain that the joints are thoroughly filled. It is not usually possible in wet trenches to keep the ends of the pipes dry and the temperature at which this material is poured should not be so high that steam is rapidly generated where it comes in contact with moisture with the result that either the compound is made porous or the runner is blown out.

(3) It should adhere well to the glazed surface of stoneware pipes so that slight movements in these pipes after the joints are poured will not produce leaks.

(4) At temperatures which prevail in and about sewers laid under such conditions, the compound should be elastic enough to permit of slight movement without fracturing the pipes, but should not become soft enough to run out of the joints. Such movements very frequently occur in unstable soils.

(5) It should not be composed of materials which volatilize rapidly at comparatively low temperatures, so that men working with the ordinary skill and care of the average sewer contractor or contractor's foreman can use it successfully.

Every material on the market, samples of which could be obtained, was tested to determine the degree to which it possessed the qualities named. They were all found more or less defective, so that they could not be used with any assurance that they would produce permanently tight joints.

The various compounds in which sulphur is used were found to shrink upon cooling, either separating from the pipes or cracking so as to admit water. Compounds having certain oils as bases disintegrated rapidly when exposed to the action of alkalies, although they resisted the action of acids very satisfactorily. Certain compounds having bituminous materials (generally pure or nearly pure asphalt bitumens) as bases after they were modified in composition somewhat by the manufacturers, were found to resist the action of both acids and alkalies satisfactorily and possessed all of the qualities mentioned above. One of these compounds is manufactured in Brooklyn. Both "Jointite" and "Filtite," manufactured by the Pacific Flush Tank Company, have proved to be very satisfactory. The chemicals used in these tests were a 1 per cent solution of hydrochloric acid and 1 per cent and 5 per cent solutions of caustic potash. Samples were submerged five days in these solutions.

"Jointite" has been used for all sewer work of this kind which has been done in Brooklyn, with very satisfactory results. Experiments were also made in the laboratory with this compound to determine the highest temperature to which it could be safely heated and the length of time that such temperature could be maintained without danger of carbonization or destroying its flexibility. As a result of these experiments and later experience, the temperature at which it is poured is allowed to vary from 350 deg. to 450 deg. F., depending on the diameter of pipe and the season of the year. The compound is not held at this tempera-

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*Engineer, Bureau of Sewers, Borough of Brooklyn, New York ture longer than 30 minutes, and it is not allowed to be reheated and used after having once cooled.

In the new Coney Island drainage system, and in other places in the Borough where the depth at which the sewers are laid below ground water is not more than 12 ft., as a general thing there is absolutely no leakage through the joints except in cases of accident or pure carelessness. We have found that the spur joint where a branch joins the main sewer is frequently carelessly made and admits water. Caps for house connection drains and for spurs are also frequently carelessly placed with the same result.

How the Compound Joints are Made and Protected

The accompanying sketch shows the manner in which pipe joints of this kind are made. A twisted hemp or oakum gasket of the proper size is first carefully rammed into the joint and occupies a depth of approximately ¾-in. A runner, usually a piece of old garden hose, is greased or smeared with wet clay and forced into the bell about ½-in. The ends are secured by a clamp in the usual manner so that the space for pouring is at one side of the crown of the pipe. The best results have been received by pouring so that the compound will run entirely in one direction about the joint, as it drives all the moisture ahead of it and completely fills the space between the bell and spigot.

In the case of pipes as large as 20-in. in diameter, where the space between the bell and spigot is very uneven, there have been numerous instances where the compound cooled so rapidly that it failed to pass the narrowest portions of the space and make a complete joint. For that reason, it is well to pour a full stream, so that it will entirely fill the space in which it runs. It is also well to remove the runners as soon as the compound has cooled sufficiently to stand alone, but while it is still hot so that any imperfections that may be found can be corrected by calking with compound hot enough to be plastic.

While it is possible to pour joints while the pipes are partially submerged, this procedure is not recommended, because of the great liability of producing imperfect work. It is our practice to run one-half of the joints before the pipes are placed in the trench. These joints are made with the pipes in a vertical position and without a runner. The pipes are then placed in position in 6-ft. lengths. At least a half-dozen joint runners are on hand and all the joints to be poured are made ready and poured at one operation without waiting for each one to cool so that the runner can be removed. In this way the danger of injuring the compound by keeping it at a high temperature for too long a time is lessened. The concrete cradle and the mortar collars are placed after the pipes have cooled. The former is used for the purpose of securing greater stability in unstable soil; the latter is used solely as a protection for the joint compound.

The repair of pipe joints several feet below water level, especially where, as in sandy soil, the inrush of water in the trench is great, is a very expensive operation and is always accompanied by the danger of injuring adjacent portions of the sewer. Such leaks are liable to continue for some time before they are discovered and to run up large bills for pumping before they are repaired. In my opinion, therefore, the cement collar in protecting the joint compound from direct contact with water or chemicals on the outer end, as it is protected on the inner end by the jute gasket, is worth all it costs.

The weights of "Jointite" used in jointing vitrified pipes of various diameters have been carefully determined. All of this pipe was double strength and had deep and wide sockets or bells. The weights were as follows:

Size of pipe, in.	Thickness of joint, in.	Depth of joint, in.	Weight of material per joint, lb.
6	5/8	1	1.04
8	[illegible]	[illegible]	1.84
10	[illegible]	[illegible]	1.84
12	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]
24	1	[illegible]	8.50

Average specific gravity, 1.50.

The cost of labor in making joints in this manner, so far as it could be determined, was almost exactly double the cost of making plain mortar joints. It is usually very difficult to determine this cost correctly, because the contractor considers joint making one of the minor operations which does not require much care or system, and it is left to a "skilled" laborer or the inspector to manage the operation.—Engineering News.

Color Varieties in Brick

ONE of an observing mind cannot have failed to notice the increasing beauty and diversity of that once rather monotonous object, the brick house. There has been a veritable blossoming of color within the past few years. In order to understand how this has come about it is necessary to have a few facts on the subject of clays in their relation to brickmaking, says C. C. Johnston in Clay Products.

Generally speaking, a brick is light or dark according to the amount of iron in the virgin clay. We might have houses made of almost pure white bricks except for the expense. Clays in which the quantity of iron is only a few hundredths of one per cent are needed for the more refined industry of chinaware, as it is popularly known. The buff-burning clays are those which are low in iron, but still have enaugh to spoil them for the purpose named. It is from these that we get all of our light shades of brick. They would not yield much color variety but for the ingenuity of the brickmaker.

By adding to the clay a certain mineral substance of an iron nature he changes what otherwise would have been a buff into a beautiful grays with which we are familiar. Again, he can adulterate with red-burning clay and run a whole range of buffs until he reaches terra cotta. Changing his tack, he may so manipulate the drafts of the kiln in burning as to force carbon from the coal into the face of the bricks, and secure novel and attractive effects, from buff to chocolate, and even gun-metal. A further expedient is to mix grains of iron with the clay. The grains fuse when the brick is fired, producing the speckled brick which we now see so frequently. Iron in the granular state forms part of the original body of some clays. The effect upon color, whether the particles are natural or are added as an ingredient, is not that of a pigment in the true sense. The iron influence proper exists in every atom of the clay and gives a uniform color to the brick throughout.

One manufacturer makes a feature of a combination for which a bough of autumn leaves was actually used as a model, both for colors and natural blendings. At the other extreme are houses which are purposely given an aged, sober appearance. In its appeal the new brick is similar to that of the half-tone engraving.

With the rough-face brick, as with the smooth brick, [illegible] are made of fire clay, a substance mined in the form of rock at a considerable depth from the surface. But for the more pronounced colors, in the case of the rough-face brick, shales and even ordinary surface clays are freely used. Some of the very impurities of the baser clays are found to be rich in color. What would be a blemish to a smooth brick adds to the unconventional beauty of the rough-face brick. In a single brick unit there is often a mingling of various colors, the reds and browns being shaded into purple or green, with suggestions of gold. General color uniformity, however, can be preserved at will by the nature of the material employed and the sorting of the brick as it comes from the kiln.

Constructional Features of the C.P.R. Banff Springs Hotel

Staff Article

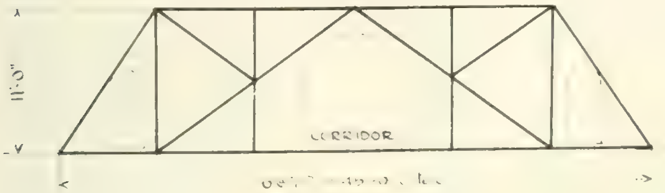
CONSTRUCTION has been completed on the large reinforced concrete addition to the Canadian Pacific Railway Hotel, at Banff, in the Rocky Mountains, largely increasing the capacity and the conveniences of this already popular resort. This hotel is now one of the largest of the C. P. R. hotel system, and contains almost 400 guest rooms, with all the necessary mechanical equipment and other facilities for such an establishment, including, besides power plant and heating system, a laundry and a large self-contained open air swimming pool. The situation of the group of buildings is almost ideal, being at an elevation of 4,500 feet above sea level, on a slight rise in the valley of the Bow River, which at this point makes a right turn, with a small falls, before being joined by the Spray River below the hotel. The main hotel structure occupies the lower extremity of this rise, parallel to its length, and has a maximum length of 550 feet, with a principal depth of 200 feet, exclusive of the swimming pool, and a maximum height of 175 feet above the main footings. In addition, there are minor structures, including the boiler house and servants' quarters, besides small out-houses. The original building was entirely of timber, and additions of the same construction have been made from time to time, the most important consisting of two terminal towers, one of five storeys, the other of six storeys, completed in the spring of 1911. The construction of the concrete swimming pool was then commenced and upon its completion work was started upon the larger reinforced concrete addition, together with the detached servants' quarters. Aside from the interest attached to the completed structures, the work has an addiional interest due to conditions incidental to the isolated situation—two miles from the nearest tracks, with a rise of 300 feet above—besides the necessity of carrying on construction during the time the hotel was in use by the guests, without interference, and also during the severe winter weather prevalent in the Rockies.

C. P. R. Banff Springs Hotel.

The recently completed addition consists of a tower, 200 feet long by 80 feet wide, and 134 feet high from the footing to the main ridge of the roof, with a steep peak rising another 30 feet high. At the base of the tower there is a three-storey wing having a total length of 260 feet and a width of 72 feet, containing the dining room, kitchen, and service. Except for the entrance lobby and hallways, the entire structure is devoted to guest rooms, there being a total of 215 rooms, with 73 private baths, the whole having approximately 135,000 square feet of floor area.

The entire construction is of concrete, with the exception of the terra cotta partitions, the building serving as a fire-wall to divide it into two distinct parts, so that a complete demolition of this hotel, as happened recently at St. Andrews-by-the-Sea, is well nigh impossible. The public spaces are tastefully finished in rough cement plaster effects, with B. C. fir stained a deep brown, fir trim, and red quarry tile floors. The bed rooms and corridors have cement finished floors with carpets, and fir trim. All the bathrooms have Keene cement wainscotting. Some idea of the size of the building may be gained from the fact that there are 150,000 sq. ft. of partitions, 6,300 sq. yds. Welsh quarry tile floors, 300,000 sq. ft. of plaster, and 20,000 sq. ft. of Keene cement in the structure, besides 143 room telephones, and 1,145 electric light outlets. Two passenger elevators, together with one freight and one service elevator, and one dumb waiter, all of the hydraulic plunger type, have been installed.

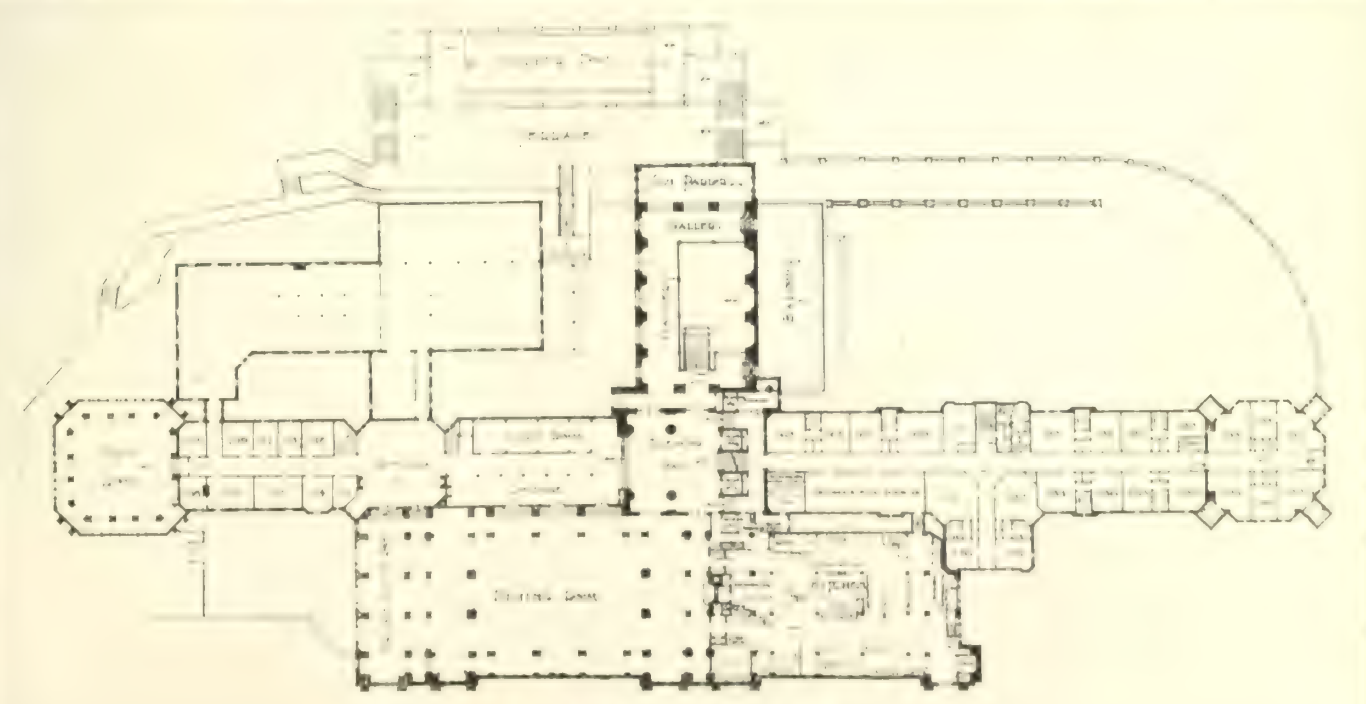
With the exception of certain steel trusses and plate girders, the building is entirely of reinforced concrete. The exterior walls are of blue limestone, laid dry, and backed with concrete. The stone was quarried close to the hotel. The blocks were readily split, and in the walls the stretcher bond, with deep raked joints, combined with the smooth surfaces of the concrete details, is very effective. The architecture may be traced to certain of the French Chateau style, the smooth walls, being unbroken by projecting details, and the sheer roofs pierced with dormers. On the ground floor there is a large entrance hall, 48 feet wide by 80 feet long, and 23 feet 6 inches high, with no interior columns, the floor area above being carried to four steel trusses, 45 ft. 6 in. centre to centre of bearings. The trusses are masked in thick partitions, with doors cut through at each end and an 8-ft. corridor in the centre. In order to allow for the corridor at the centre of the span, it was found necessary to modify the usual type of latticed truss so that there would be no members in the lower half of the two middle panels. This has been accomplished by running the diagonals in these panels through into the next panels, thus:



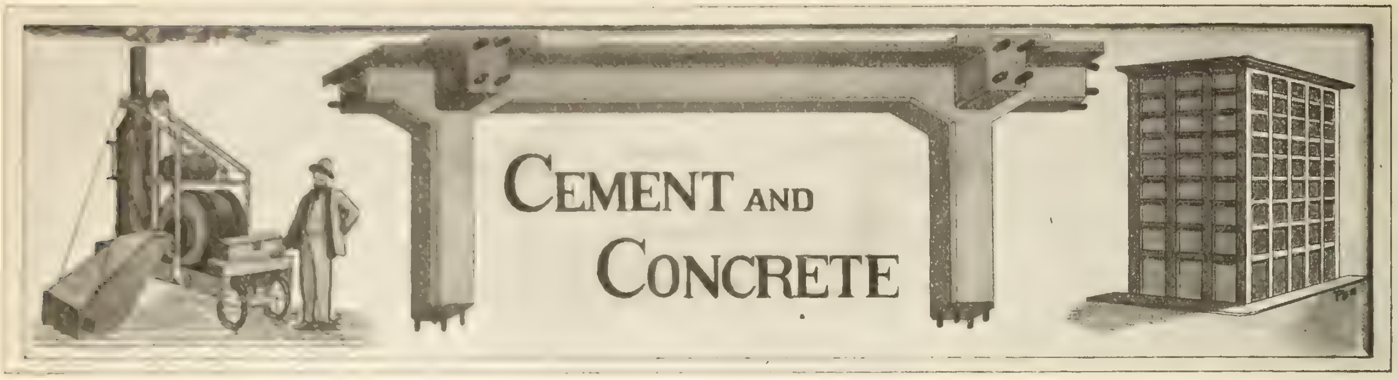
The gauge lines of the top and bottom chords are 11 ft. apart, the chord sections being built up of four 6-in. by 4-in. angles and two 20-in. plates. The main dining room is 150 feet long by 75 feet wide, lighted by four large ridge skylights overhead. These skylights are carried by four plate girders having clear spans of 51 ft. 6 in., the two inner girders having 30-in. webs, with flanges of 6-in. by 6-in. angles and 15-in. cover plates. The framing of the dormer openings in the steep pitched roof slopes presented something of a problem in the forms for the concrete, but otherwise the design of the superstructure was reasonably simple. With the exception of these features, the construction is of the beam and girder type, with solid floor slabs, and hooped columns. Practically all of the reinforcing steel was supplied by the Trussed Concrete Steel Company of Canada, Limited.

The work of tearing down the central portion of the old wooden building was commenced late in the fall of 1911, and blasting and excavation were continued throughout the winter. The excavation in the main was solid rock, a laminated trap very difficult of removal forming the major portion. The entrance to the new hotel was to be from the east, so the construction was carried out almost entirely from the west side. Due to the slope of the ground on this side, there was some difficulty in storing materials. Two hoist towers, with carpenter shop and concrete plant, besides the stone-cutting yard, were established on the main axis of the tower, abutting the dining room wing, and practically all concrete and other materials were handled from this point. Concrete materials were dumped at the mixers on stock piles, whence they were hoisted 20 feet to the mixer platforms in an Insley stone boat. Concrete was mixed in a ½-yd. Ransome mixer, with interchangeable gasoline and electric motor drive, discharging into an Insley combination bucket and skip elevator dumping into a 40 cu. ft. Insley hopper. The concrete was conveyed to the forms in Ransome concrete carts. Two Marsh-Henthorn hoisting engines were used—one of 20 h.p., handling a 5-ton American stiff leg derrick and an elevator for materials, and the other of 18 h.p. for hoisting the concrete and for a 2-ton Insley portable boom derrick. Forms were built in a shop, where there were installed two C. H. & E. portable saw rigs, electrically-driven, and a gasoline-driven band saw rig. Gravel was at times shipped in from near Calgary, but the uncertainty of deliveries warranted the establishment of a gravel plant on the Bow River, some seven miles below the hotel. River gravel from a bar was loaded into two-wheel carts and hauled a quarter of a mile to bins on a spur track. Six men loaded from the bar into the carts—six carts, with three drivers, averaging 75 yards a ten-hour day. The carts were dumped into a 27 cu. ft. Insley bucket, which was hoisted to the top of the bins by a 12 h.p. engine, and dumped. The hopper bins had a capacity of 150 cu. yds. and loaded direct into cars through quadrant gates. All of the materials entering into the construction were hauled two miles from the sidings at Banff Station, ordinary box wagons and teams being used by the Brewster Transfer Company, who had the contract for hauling. As there were over 8,350 cu. yds. of concrete, nearly 150,000 terra cotta partition tiles, and almost 300,000 sq. ft. of plaster, placed in the building, with other materials in proportion, this alone was a considerable task.

The total cost of this building was about $1,500,000. The entire design and construction was carried out by Mr. W. S. Painter, formerly C. P. R. architect, and later of Messrs. Painter & Swales, Montreal and Vancouver.



First floor plan, Banff Springs Hotel



Reinforced Concrete in Theory and Practice

By Alexander Melville, C.E.

PLAIN concrete is a most excellent material in many ways, and ideal, for instance, for such structures as engine foundations, where weight is essential, but it has a serious deficiency in its inability to resist anything but the lowest tensile stress. Also such tensile strength as it has is easily destroyed by vibration.

By the employment of steel to take the tensile stress, we get a fabric at the same time low in cost and applicable to structures, in which plain concrete would not have been used.

How varied are its uses you will find by looking over the advertisements of any periodical dealing with reinforced concrete. There you will find it is employed in almost any type of structure—even boats, incinerators, and tombstones. But one must not take advertisements too seriously. I speak from personal experience. Many things to which it is applied are, I presume, by way of experiment, and one must recognize that by experiment to a very great extent the boundaries of its uses may be extended. But it is unfortunate that experimental uses should be put on the market and advertised as the soundest methods of construction for certain needs. By allowing their enthusiasm to run away with clear judgment, certain advertisers have advocated the building of classes of structures which have proved failures, and have done reinforced concrete decided harm. Whatever is may be used for in the future, at the present state of knowledge of design it has limitations, and is not a universal salve for all structural ailments. It has often been advocated for things which proved unsuitable, uneconomical, and faddish.

One must not forget, of course, that applications which appeared wrong a number of years ago have, as a result of experiment, consequent better design, and improved methods of working, now been accepted as right, and are established.

I think there is too much talk about "systems." It makes for confusion in the mind of one who does not understand the principles underlying all designs. There are a great many who claim a new system and take out a patent by virtue of cranking a bar in some new place; but perhaps this is only natural in the rush to sell at the beginning of the demand.

Unfortunately, the older civil engineers were disinclined to take up seriously a method of construction apparently, possibly because for the purpose of design Molesworth was useless. But as reinforced concrete was a fabric of undoubted value, a new branch of the profession was of necessity created.

I cannot but think that not a few specialists make a difference in the placing and the cranking of bars and the form of stirrups, deliberately for the purpose of being able to talk about a "system." I believe that gradually so-called systems will disappear, and work will be carried out to the designs of engineers as it was before the days of reinforced concrete.

Before this comes about, however, I am afraid we will have to listen to the advantages of the various systems from their biassed advocates for many years. In listening to them, I would advise you never to allow yourself to be impressed at the time, but to consider everything coolly and alone next day. I find this a most excellent principle to follow. If there is something you are not quite clear about ask the representative to call again. He will run to you. Generally speaking, you will be on safe ground if you clear him out as soon as he has answered your queries.

In starting to consider any of their designs remember that it does not matter what the particular system is or whether it has a name in hieroglyphics; there is nothing mysterious about it except possibly the special advantages claimed.

The same principles underlie, or should underlie, all designs. Indeed, the most difficult problem is one which engineers and architects have studied, and without the use of a book on reinforced concrete, namely, the determination of the stresses in a member of a structure. When comparing various designs for the same structure one finds, as in dealing with any other structural material, that there is every possible degree of goodness or badness, and in this lies the most of the difference between the various systems as carried out.

The various so-called systems are legion. I have not time to explain their individual advantages or discuss the claims that are made for them, or even describe their particular fads. Some I dare not describe, as I would be apt to confuse them. Nor would I recommend that you should or should not adopt Hennebique system because of the smithed ends to their bars or because of their type of stirrups; or Considere, for their spirals and hooks; Coignet, for their method of dealing with shear; or Kahn and the Indented Bar Company, because their bars are something original and expensive. Nor will I condemn or praise those who employ a particular form of mesh, such as Clinton, Johnstone wire lattice, or triangle mesh. There is nothing wrong with any well-known system, because there is nothing wrong fundamentally with the combination of steel and concrete. However, you have only to listen to the representatives of the various systems to find out that there is something to be said for every one, even those that could never be put into practice.

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[*] Abstract of a lecture at the Northern Polytechnic Institute, London, Eng.

There are uses for them all. Even the system which claims to reinforce metal may be used with complete safety if one has plenty of money to spend.

Novel Reinforcing Material

I know a builder who undertook to erect a small single-storey building in reinforced concrete without the help of a specialist. When the walls were half up he proudly asked me to inspect his work. To my astonishment, I found an extraordinary disposition of bars appearing out of the concrete. They were twisted in all fashions and braised at junctions without any apparent reason.

Gradually I understood, and could not restrain my laughter, but I did not offend the builder. "Yes," he said, "so far the walls are built entirely with ends and other scraps of bedsteads." I may say he disdained patenting his system, and yet that building has been standing for a number of years. I do not know that I could unreservedly recommend this bedstead system, but yet it has its use, and it must have been a very economical design.

What one ought to do in comparing competition designs is never to think of a system at all, but look for good design, and remember that all designs we look at are, or ought to be, based on the same fundamental principles.

Another thing one should do is to find the amount of steel and concrete employed by each designer, and if you find one which is considerably different, look into his design most carefully, for it stands to reason that in well-designed work, if the same loading and factor of safety be taken, there can be very little variation in the quantities of these materials. It is advisable, also, to see that the quantities given are approximately those that go into the work of the successful tenderer.

There is a type of construction which I find some are apt to place under the heading of reinforced concrete, but a little consideration would show it is something quite different. I refer to the fireproofing of steel structures by encasing in concrete or fireclay blocks and slabs. These blocks and slabs are not intended to be stressed, but are used merely as a protection of steelwork against damage by fire.

I pointed out earlier, that structures had been erected in reinforced concrete which were not suitable for its use in the present state of knowledge. I would like to name now a few structures to which it is admirably adapted if well designed and well constructed.

Advantages of Reinforced Concrete

First of all, a word as to its advantages. It forms a monolithic structure, and thus makes a much sounder building than the old disjointed method of building steelwork loosely into stone or brickwork. It is fireproof in varying degrees, depending on the aggregate used in the concrete and the cover of the steel. It is economical both in first cost and in maintenance. In such structures where steelwork is exposed the cost of frequent painting is saved.

If properly imbedded in the concrete the steel will not corrode under water. A consideration on expensive sites, also, is the possible saving of room in the thickness of the walls.

For bridge work, reinforced concrete is admirably adapted. It is economical, particularly in upkeep. In a few cases but that of a high viaduct over a river, with much traffic, is the erection expensive.

Again, I think it is much more capable of architectural treatment than a steel structure. It is a highly suitable material for piles and for jetties generally. There is no corrosion of the steel and no rotting, as in timber. Toredos find it indigestible. It is also highly suitable for retaining walls and for tanks, in both cases being economical and saving considerable room compared with stonework. In tanks, also, there is not the maintenance that is chargeable to steel. It is being used with increasing frequency and is thoroughly satisfactory for such structures as silos.

In floors, columns, and girders, in factory and public buildings, it is also employed satisfactorily, but I do not know that it is to be recommended for walls in the majority of buildings. Walls can be made thoroughly sound and very much thinner than is the case with the older methods, but I am afraid that the architect with a reputation for a good elevation (and this is the only part of a building that later generations consider) will wish something more than strength. For factory walls it is all right if there is no intention of future extension. But if there is, and openings for doors, etc., are to be cut or the face of the building taken down for the purpose of joining, I am afraid one would be faced with a tricky problem. It would be almost necessary, also, to employ the same experts for the extension, as an accurate knowledge of the position of the reinforcement and the original method of design would be essential for safe working. It would also be necessary to employ him so that responsibility for any damage to the old building could be fixed.

We will find the most popular type of public building in the future will be a reinforced concrete framed structure, with reinforced concrete floors and stone or brick thin walls.

For raft foundation work, reinforced concrete is invaluable, even although it is impossible to do more than guess the external forces acting on it. (Competitive designs for a raft would be excellent in indicating who are our bold engineers and who are our timid.)

When an architect has a structure in reinforced concrete to carry out, he employs, either through choice or competition, a specialist, and says, "Look here, your representative is the most superb talker I have come across. I want you to design some work for me." They look pleased, and give him quantities and drawings, which he submits to all contractors in sundry, or a few of impeachable character, and the contract is fixed as the result of a competition in price only.

In the second case he deals immediately with the contractors, and the contractors send the inquiry to their pet specialist or to the specialist to whom they have tied themselves under money penalty. In this case the contract is fixed as the result of a competition in price and design. But in this case design is merely a question of quantities, as no specialist does, or has time to, make complete drawings for the job in the short time at his disposal before it is tendered for.

Thus it looks as if the first method would assure the best job being made. There is, however, another point to consider. By dealing with the contractor you have only one man to deal with, but by adapting the first method you are at one corner of a triangle, and if anything goes wrong with the work, you rather wish you were at the end of a straight line leading direct to one on whom you could fix responsibility.

This, however, is not a point to be much afraid of if one is careful to select a thoroughly capable firm of specialists to design the work, and, what is quite as important, to allow only those contractors to tender whose workmanship is beyond [illegible] a thorough understanding of the importance of keeping strictly to the working drawings, although they may show in certain places very awkward pieces of construction.

Do not, on any account, allow plasterers or others whose knowledge of concrete work is based on the putting in of concrete foundations specified at six to one, executed at ten to one. If it is their first tender for reinforced concrete work then prices will be alluringly low, and if there is a good clerk of works on the contract they will have to be a firm of substantial standing to withstand the monetary loss. Another very important factor is the employment of a thoroughly good clerk of works; not an habitual growler, or one who spends all his time making test cubes, but a man who really understands the class of work. A good clerk of works is a blessing to a job and to the contractor. He will not keep work back, but will do his best to help a contractor to get ahead quickly. He will be decided as to his reading of the specification, and he will stand no attempt at scamping or inferior workmanship. His advice will be given freely as to the scheme of operations, and it is often invaluable, as he has had experience of the methods of work of various contractors, and is in a position, if he be an intelligent man, to compare them and see clearly what are the best.

(**Concluded in next issue.**)

The Use of Marble in Architecture

DURING the last twenty years marble has been employed more and more in architecture, but in America it has for years been used not merely for interior decoration but for entire fronts and even construction, notes a writer in The Stone Trades Journal. Public buildings, banks and insurance offices are fronted with white imported Carrara marble, and yet the effect is not altogether what one would expect. The influence of the weather soon asserts itself and the marble becomes yellow, until finally its appearance is not much different from that of the considerably cheaper sandstone. On the Continent, too, marble is being used for external decoration, but not to any appreciable extent compared with inside decoration, where both white and coloured marbles are lavishly employed. This applies especially to hotels, restaurants, banks, etc., and also to the halls and staircases of mansions and homes of the wealthy. But any definite artistic principle as a whole seems to be sadly lacking; frequently streaked and variegated marbles are used for sculpture, for floral and mural designs. The immediate effect is that there is something distinctly out of place, and Continental architects do not yet seem to have recognized fully that veined and coloured marbles are best reserved for large surfaces, pillars, etc., and that a high and glass like polish is absolutely essential to the right effect.

Apart from constructional work, marble is beginning to be largely used in interior decoration, principally in businesses where there is a large amount of wear and tear, and where absolute cleanliness is essential. Mention must also be made of the increasingly elaborate lavatory fittings; they too have opened up a large and important field to marble, and the same may be said of the large hotel and restaurant kitchens as well as the hospitals. The utility of marble for electric switchboards and furnishing purposes is well known, although only of secondary importance to the subject of our article.

The use of marble for interior decoration dates back to early times and undoubtedly began with the ancient Romans, according to some authorities after the Egyptian conquest, according to others much earlier. Be that as it may, it is certain that the use of costly marbles came into fashion during the latter decades of the Roman Republic and that the stone was imported and considered a great foreign luxury, far too costly for general use. After the downfall of the Roman Empire, and the capture of Constantinople by the Turks, marble sank back into oblivion for centuries, not to emerge again until the awakening following the dark ages. From the 12th century on, Spain, Italy, France, Germany and the Low Countries employed it extensively in ecclesiastical architecture and gradually it became more general on the entire continent until the outbreak of the French Revolution called a halt at the zenith of its popularity. Then marble fell into disuse once more, to remain so for many years; but it is to be hoped that there are signs of a restoration to the place it has rightfully held for centuries.

In interior decoration the architect has a scope for working on either a combination or a contrast of colour which is sometimes not properly appreciated. True it is no easy task to suit the delicate, softening, effect of marble to the high glaze and density of colour of tiles and other artificial products. Marble absorbs and retains the light whereas the impenetrable polish of artificial stone hurls it back with a vengeance, making the marble appear insignificant. Happily these contrasts are noticeable only in large surfaces; in smaller ones even quite artistic combinations are possible between natural stone and the work of man. Ancient Roman mosaic floorings are the best proof of this. This combination is also possible for mural decoration and instead of presenting a vast unbroken expanse that can only tire the eye, be it now marble or any other material, a wall could well be relieved by ornamental pilasters and friezes, giving the artist room for display of taste and fancy.

It need perhaps hardly be mentioned that the great architects of old employed coloured marble as well as jasper, agate, and lapislazuli whenever it was obtainable. Sometimes it was a column that was fashioned from it, sometimes a wall or dado, a vase or a bowl. If the design of the stone showed up prominently it was used for large surfaces, but as soon as there was any tendency of monotony the stone was divided into small pieces. Frequently a large slab, richly veined and streaked was framed in a border of multi-coloured mosaic—especially in Moorish and Venetian art. Sometimes, in the case of rich and many coloured porphyry and marble a narrow band of less conspicuous marble first surraunded the slab, and then came the actual masaic frame. This consisted of either cubes, stripes or chips of fine marble, majolica, glass, or mother-of-pearl. These many examples of ancient taste show what can be accomplished even with infinitesimal fragments of the most varied materials, such as enamel, glass and gold in addition to those already mentioned.

There was a time when the interiors of most hotels and restaurants were panelled in wood four to six feet high, and only when this panelling began to be carried right up to the ceiling did the re-action in favour of stone set in. The normal is obvious, and should remain a warning not to overdo the matter of large surfaces without any relief.

If in the past too much importance has been attached to the uniformity of material, the reverse may almost be maintained at the present. It is indeed not uncommon to see pillars, front, door and window frames each in stone of different colour and design with apparent complete disregard of the fact that some of the veinings completely overshadow others. A little more harmony would conduce greatly to a better effect and the stone should be chosen with a little more consideration for its purpose. It can well be done without detracting from the artistic appearance of the whole.

For sculptural work a plain unmarked stone is the only right one and whilst in straight columns veins and markings do not matter, they detract immensely from the appearance of a capital. Here, like in sculptural work, light and shade play an important part and if a variegated stone is used it is often unavoidable that places which should show the highest of high lights are marred by some prominent marking or another, whereas parts intended to be shaded, show up stark white.

In these circumstances, Nature's work will never harmonize with that of the sculptor and, on the other hand, no matter how beautiful the marking and veining of a stone, it is absolutely wasted if not given due prominence.

It is much to be desired that architects and designers should familiarize themselves with marble and its literature, for frequently, when the contractor designates a certain stone as unfit for any particular work, it is thought that he has merely an axe to grind. And then when the work is unsatisfactory the marble is blamed.

Only too often do architect and builder alike expect impossibilities from marble. It is rare to obtain variegated marble without cracks and flaws and even to get the same coloured slabs from one and the same block is a matter of luck. The main question is whether the marble is intended for interior or exterior use. If for the latter no matter which kind is chosen its weathering qualities should be beyond dispute, for nothing discredits any kind of stone more than a rapidly decaying facade or decoration.

Summing up, it can be said that the use of marble, both uncoloured and variegated, for architecture as well as decoration is increasing; yet marble deserves to be even more generally used, for there is no other material that gives the architect the same facilities for design. The evenness of surface, the quiet blending of colours, that can be arranged render it unapproachable as a means of artistic expression and real decorative effect. Its number of qualities and different colours are legion and, while imitations abound, the real article more than holds its own, and no artificial product can seriously challenge comparison with that from Nature's workshop.

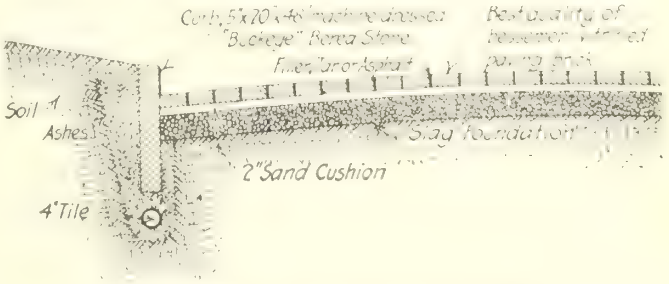
Coal tar is now used as a fuel in steel furnaces at Gary, Ind. It is first heated to liquid form, then sprayed into the furnaces, mixed with blasts of air under pressure. A somewhat similar use of coal dust has been made as an experiment. The dust is fed to the furnaces in a continuous stream, mixed with air under pressure. The success of this plan has been so great as to raise the question whether it would not be economical to crush and grind all the coal used in large manufacturing plants. The dust burns with an intense heat. There is no smoke, because the combustion is perfect.

The Economics of Brick Pavements

COST of construction and cost of repair and all else is not the full measure of the economy of a road surface. The greatest element affecting the economy of any road is its out of repair condition. That road which calls for the most frequent repairs is the road that is most likely to be out of repair, and it is the road that in the sum of lapses of time in which it is out of repair, aggregates a total detraction from the road's worth which by the lesser load hauled, the broken spring, the injured horse, the extra wear and tear of the vehicle, if converted into dollars, would often equal in a short period of time, the entire original cost of the road improvement.

When a road is out of repair, the road investment is yielding no return. The road as a whole is only as good as its worst portion, even the rule of averages will not apply. On the other hand, by inverse ratio, the road approaches its maximum worth as repairs are eliminated.

The original cost of a brick road is not necessarily excessive. The cost of grading, drainage, bridging and the entire preparation for placing the foundation and wearing surface, should be alike for all types and is therefore no more expensive for a brick road than is required for the least expensive type of wearing surface. These preliminary structures are not readily injured, either from wear or tear or from any character of climatic influences. The foundation is likely to remain intact. With the brick wearing surface placed upon it, ample protection for the durability of all the work incident to such preparation is afforded.


Curb, 5"x20"x48" machine dressed "Buckeye" Berea Stone
Best quality of Bessemer vitrified paving brick
Filler, Tar or Asphalt
Soil
Ashes
Slag foundation
2" Sand Cushion
4" Tile

Brick pavement with slag foundation, Niles, Ohio.

Specifications for Slag Foundation for Brick Pavements

SLAG, under proper methods of construction, is an excellent foundation material for paving streets and is the nearest approach to concrete obtainable, according to Harvey F. Brown, Engineer of the Borough of Charleroi, Penn., writing in the Engineering News. The use of slag means a saving over concrete foundation of approximately thirty cents a square yard—this in the iron and steel districts where slag is readily obtainable. Our contemporary learns from Wm. V. Alford, City Engineer of Niles, Ohio, that slag has been used with much success under brick pavements in that state and gives the following specifications for this foundation:

(1) Specifications for grading, rolling and crowning the earth foundation or subgrade are to be the same as for concrete foundation.

(2) **Slag Foundation.**—There shall be placed on the subgrade 6½ to 7 in. of air-cooled blast furnace slag from the Carnegie Steel Company, of Youngstown, Ohio, or slag of the same specific gravity. This shall be the [illegible]

[illegible] larger than [illegible] in any dimension. It shall be evenly distributed [illegible] the subgrade. This can best be done by the [illegible] blocks as directed by the engineer. When thus levelled the slag shall be rolled until there is no appreciable settlement. With this rolling careful examination [illegible] low places in the foundation must be searched for and when found the slag must be loosened with a pick and re-rolled with sufficient added material to bring the low spot to an even grade and surface level and of the same density as the rest of the foundation.

(3) The slag foundation shall be rolled with a 10-ton steam-roller, weighted if directed by the engineer. The rolling shall begin at the curb and work toward the crown, the spacing of the rolled portions to be as directed by the engineer. The rolling shall progress toward the center until the entire foundation has been keyed in at the crown, and all interstices have been reduced to a minimum, in the judgment of the engineer, and all low places corrected.

(4) **Slag Sand**—Slag sand shall be placed on the foundation and worked into all voids by sweeping with a steel or rattan broom. The sand must be evenly distributed over the slag foundation with shovels, from convenient sand piles placed on the burm of the roadbed. After each passage of the roller the sand must be thoroughly "hetcheled" with a stiff brush as above noted. This process shall continue until there is a smooth, hard and convex surface, acceptable to the engineer.

Water shall be applied by sprinkling as directed during the last half of the rolling in of the sand. It shall continue until a grout is formed with the slag, sand and water, which must wave slightly before the roller.

The foundation is now ready for the cushion of sand. This sand cushion shall be placed as noted in the specifications for concrete foundation.

At the invitation of Mr. H. C. Harding, a number of architects and contractors, on June 9th left Montreal in a special train to inspect the plant of the National Builders' Supply and Enamel Concrete Brick Company, Limited, at Mascouche, P.Q. Mr. Harding explained the process of manufacture, pointing out the advantages of the brick, and briefly sketching the history of the company. It was, he stated, a new industry for Canada, the capital for which had been found in Europe. Concrete bricks, he predicted, would eventually take a leading part in structural materials in Canada, and architects were invited to investigate the claims made by the company. It was intended to develop the industry throughout Canada, and sufficient business had been secured to warrant ordering another machine to be erected at Mascouche. After luncheon several visitors spoke, wishing success to the enterprise.

It is with much regret that we have to record the death of Mr. Robert H. Skelton, of Mimico, Ont., manager of the Ontario Sewer Pipe Company, Limited, since January, 1909. The late Mr. Skelton was born at Drayton, Ont., 44 years ago and entered the service of the Grand Trunk Railway at an early age, remaining with them many years, in fact until he became identified with the Ontario Sewer Pipe Company. He was the first Reeve of Mimico and rendered the municipality excellent service in this capacity. His death—from cerebral hemorrhage—came as a great shock to his friends and business associates. Apparently he had been in the best of health. He was stricken down suddenly on the way home from his office on Wednesday, June 10.

Mr. James L. Taylor, road superintendent for the county of Wentworth, Ont., has accepted a similar position at Parry Sound.

Personal Mention

Mr. Hugh McDougall, contractor for the new Martin block, now in course of construction at Wallaceburg, Ont., was seriously injured by falling from the second storey of the building a few days ago.

Mr. J. H. McMichael, of Chicago, the inventor of the Pneumatic Concrete Mixer, has been on a visit to Montreal. Later he will probably reside in that city with a view to superintending the work of the Pneumatic Concrete Placing Company of Canada.

Mr. J. P. Case has been appointed Canadian representative for the Brown Hoisting Company, succeeding Mr. F. A. Peck, who has resigned. Mr. Case has been identified with the Brown Company for many years and is entirely conversant with all Brown hoist products. He will spend all his time in Canada and will be assisted in his work in this territory by Mr. Hoyt E. Hayes.

The Retiring City Engineer of Winnipeg

Lt. Col. Ruttan.

Lt-Col. Henry Norlande Ruttan, who has resigned the city engineership of Winnipeg after a continuous service of nearly thirty years, was born at Cobourg, Ont., in 1848. Prior to his connection with the City of Winnipeg he had extended experience both as an engineer and as a contractor on the construction of the Intercolonial and Canadian Pacific Railways. He has had a distinguished military career and possesses in addition to the Long Service Decoration medals for service in the Fenian Raid and the Northwest Rebellion. He was a member of the first Council of the Canadian Society of Civil Engineers in 1887 and was President of the Society in 1910. He will be retained by the city of Winnipeg in the capacity of consulting engineer and will receive a pension, which, combined with his salary, will give him a yearly income of five thousand dollars. Mr. Ruttan is a member of the Council of the Institution of Civil Engineers of Great Britain and of a number of United States bodies.

Mr. C. D. McArthur, whose appointment as chief engineer to Messrs. Foley Bros. Welch, Stewart & Fauquier, contractors for the Halifax Ocean terminals, was noted recently in these columns, was for five years chief engineer for the Blaw Steel Construction Company, of Pittsburgh. His first important position was that of engineer on shop construction for the Buffalo & Pittsburgh Railway, from 1900 to 1903. During 1903 he was master mechanic at the Adrian Furnace at Du Bois, Pa. For three years, 1905 to 1908, he was engaged in consulting engineering practice in New York City.

The City Engineer of Edmonton

Mr. A. J. Latornell, City Engineer of Edmonton, the activities of whose department are the subject of an article in this issue, was appointed Acting City Engineer of Edmonton in 1908 and succeeded to his present position in February, 1910. Mr. Latornell was born at Meaford, Ont., and is of French Huguenot descent. He began his engineering training in the autumn of 1898 by entering the shops of the W. A. Johnson Electric Company, of Toronto, as special apprentice. After serving in these shops and those of the United Electric Company of Toronto, he entered the School of Practical Science in October, 1900, graduating in May, 1903, with honors in Civil Engineering. His vacations were spent in survey work in the West. In May, 1903, he entered the services of the Canadian Pacific Railway as assistant to the resident engineer on maintenance of way at Ottawa, Ont. In June, 1904, he made connections with the Public Works Department of the Northwest Territories, in whose employ he continued until October, 1905, when he returned to the University of Toronto to take up post-graduate work in civil engineering. In May, 1906, he graduated with the degree of Bachelor of Applied Science. After graduating he was employed by the Iroquois Construction Company of Lockport, N.Y., and was engaged on transmission line work for the Ontario Power Company. In July of the same year he resigned to enter the service of the city of Edmonton.

Mr. A. J. Latornell.

Mr. G. A. McCarthy has been appointed engineer of railways and bridges for the department of works, Toronto, in succession to Mr. C. W. Power, who resigned recently to take up a position with the Canadian Stewart Company on the Toronto Harbor work. Mr. McCarthy graduated from McGill University; for seven years was in the engineering department of the Intercolonial Railway; was engineer of the C. P. R.; chief engineer for Algoma Central R. R. and chief engineer on Canadian power development work at Niagara Falls. From 1905 to 1909 he was chief engineer of the T. N. O., and from 1909 to 1912 was with a Toronto firm of engineers. Last year he was resident engineer on hydro work at Feather River, California.

Mr. Geo. E. Turner, Building Commissioner at Edmonton, Alta., since 1909, has resigned, his resignation to take effect on June 30. The School Board has decided to engage Mr. Turner during July, August and September as consulting architect.

Building Progress at Montreal

A new theatre will be erected on St. Catherine Street West, while several picture houses are in course of erection, one of which on St. Denis street, will mean the expenditure of $300,000. The National A. A. A. propose to build a new club house on Cherrier street, to cost $175,000; Turgeon and Ouellette are the architects.

There will be several additions to the list of apartment houses. The largest of these is one for which plans have been prepared by Audet and Charbonneau; it is a $275,000 house on St. Catherine street, Westmount. A considerable portion of the Northern Electric factory at Point St. Charles has been completed, this being the largest structure of its kind ever erected in Canada. The cost will be over $2,000,000. Work is in progress on the Ford Motor factory, which will cost $100,000, and about the same amount is to be expended in the building of a Tuckett tobacco factory. The contract is about to be awarded for an addition to the Alexandra Hospital, to cost $100,000, while the Royal Victoria and General Hospitals are also making additions to their buildings.

The most important ecclesiastical work is the new St. George's Church, Dorchester Street West, tenders for which have been called by Messrs. Barott, Blackader & Webster, the architects. It will be a very fine building, with a magnificent interior. The foundations of a church on Fullum street are completed; the cost of the building is estimated at $150,000, the architects being Beaugrand-Champagne & Chenevert. The same architects have made plans for St. Michael's Church, St. Urbain street, the cost of which will be $250,000. A synagogue is to be erected on St. Urbain street at a cost of $90,000, Mr. C. Dufort having drawn the plans. A large church will be constructed on Delorimier avenue; Mr. Marchand and Mr. Venne are the joint architects. Several new schools are in course of erection or are planned, Nobbs and Hyde having the principal designs in hand. Doucet & Morrissette and Mr. Marchand are joint architects for a large girls school on Demontigny street, the estimated cost being about $40,000. Fresh tenders have been asked for Loyola College, estimated to cost $400,000.

As compared with the last two or three years, there are few important buildings in course of erection or projected in Montreal. Probably the one involving most money is the new customs house warehouse, the foundations of which gave unexpected trouble, and which resulted in the Foundation Company being called in. A large part of the steel work is now up. The Sun Life Company's building on Dominion Square is also making considerable progress. The Bank of Toronto is rebuilding its branch, but the work has only just commenced. In addition to the bank premises there will be a large number of offices, the contract being let to the Atlas Construction Company. Tenders are in for a new office building on Dorchester street, to cost $175,000, for the Liverpool and London and Globe Insurance Company, from plans by Mr. Rawson Gardiner and Messrs. Nobbs and Hyde. Excavations are being made for an office building for the National Trust Company, on St. James street, estimated to cost $150,000, the architect being Mr. K. G. Rea, and the contractors, the Norcross Brothers Company. The city have decided to build some large stores and a garage at a cost of $120,000 and also to make a start with libraries. The plans for the initial library will be open for competition, the first prize being $1,000, the second $800, and the third $500. The neighboring city of Westmount will construct a new city hall, and here, too, the plans will be open to a competition by architects.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

J. A. King & Company, Limited, is a new Montreal concern incorporated with a capital of $150,000, to manufacture and deal in waterproofing and building materials.

Plans have been completed for a new registry office building to be erected at Toronto at a cost of $400,000. The architect is Mr. C. S. Cobb, 71 Bay Street, Toronto.

The Welland County Council have awarded to the Standard Crushed Stone Company, Niagara Falls, a contract for thirty-five miles of road work running into $180,000.

A sewerage system, estimated to cost $100,000, is to be installed at Whitby, Ont., and tenders for the work are now being received. The engineer is Mr. T. Aird Murray, of Toronto.

The County of Laval, P.Q., and the municipalities of Longueuil and St. Recollet are extending the work of laying concrete pavement, and the village of St. Rose are starting on similar work.

At Montreal, the erection of a new theatre estimated to cost $200,000 is projected by Maurice Wolff, 150 Peel Street, Montreal. It is expected that a competition for plans will be arranged shortly.

Hon. J. A. Tessier, Minister of Roads for Quebec, has been requested by a deputation of Mayors or the counties of Levis and Lotbiniere to construct a road from Quebec to Montreal on the South Shore.

Defective wiring is thought to have been the cause of a fire which broke out at the Woodbine Avenue sewage disposal plant, Toronto, on June 11, involving $500 damage to the contents and $25 to the building.

A garbage disposal plant at a cost of $720,000 is the latest project of the Toronto Board of Control. The plans are for a central incinerator and reduction plant to be located in the Ashbridge's Bay district.

Mr. Joseph Gosselin, a well-known contractor of Levis, Que., has been awarded the government contract for the construction of the Transcontinental station on the Champlain Market site. The station will cost over $100,000.

Tenders are to be invited shortly by the architects, Messrs. Stewart & Witton, for a 16-room school building at Hamilton, Ont., for which plans are now in progress. The cost of the structure is estimated at $100,000.

Building permits for May in the city of Quebec amounted in value to $461,595. The total for the five months since January 1 is $1,252,114, which is more than double the amount for the corresponding months of last year.

Steel work is in progress on the new customs house which is being erected at Fort William at a cost of $175,000. The general contractor is Mr. M. H. Braden and the contractor for the steel work is the Hamilton Bridge Works Company, Limited.

Foundation work has been completed for a new church estimated to cost $150,000 for the Parish of St. Eusebe de Verceil, Montreal. No tenders are to be called before July 1. The architects are Messrs. Beaugrand, Champagne & Chenevert, 182 St. Catherine Street East, Montreal.

The Polson Iron Works, Toronto, was visited by two serious fires on the morning of June 14, entailing a loss of about $20,000. The first fire, which completely gutted the blacksmith shop, broke out early in the morning, and was the cause of the second blaze, which partially destroyed the machinery shop. The loss in both cases is covered by insurance.

Quebec Government engineers left last week for Lake St. Francis to do the preliminary work in connection with the construction of the great storage dam on the St. Francis River. This dam will raise the water in the lake twenty feet. It is understood that the government has abandoned its work on the St. Maurice River owing to disagreement with the power owners.

Work is in progress on the half-million-dollar post-office now in course of erection at St. John, N.B. The building is to be 200 ft. by 160 ft. in dimensions, two storeys high, of artificial stone construction. The stone work is now up one storey. The architect is Mr. G. E. Fairweather, St. John, and the general contractors are Messrs. Rhodes, Curry & Company, Amherst, N.S.

The John Raper Piano Company, of Ottawa, are carrying out extensive alterations and extensions to their establishment on Sparks street. Included in the alterations which are planned will be the devoting of the main floor of the building and the mezzanine floor to sound-proof demonstration rooms. The work is being carried out under the direction of Mr. George, architect.

The Parliament Buildings, Toronto, was the headquarters last week of a conference, taken part in by representatives from every province in the Dominion, with the exception of Alberta and Prince Edward Island. The object of the conference is to secure uniformity in boiler inspection laws for the whole of Canada, and as such it was of great importance to Ontario boiler manufacturers, whose representatives were present in large numbers.

Extensive operations are involved in a contract which Messrs. Foley Bros. Welch, Stewart & Fauquier have for the Halifax Ocean terminals. This contract includes the construction of quay walls 6,534 ft. long, including 13,000 tons of steel, 275,000 cu. yds. of concrete; 467,000 cu. yds. of excavation and dredging, and 3,000,000 cu. yds. of fill. The contract time allowed for the work is three years, and the contract price is about $5,500,000.

Messrs. Sherwood & Sherwood, general contractors, Sudbury and North Bay, have opened an office at 111 Mail Building, Toronto. They have started work on several contracts received recently from the city for sewers and sidewalks. Operations will start immediately on the Dunkleman warehouse, for which they have the general contract. Contracts for several stations on the Cochrane Division of the T. and N. O. have just been closed. Mr. A. C. Morgan is in charge of the new office.

Plans are practically completed for the erection of a half-million-dollar crucible steel plant at London, Ont., where a ten-acre free factory site is said to have been offered by the Argyle Land Company. The plant will employ about one hundred men at the commencement, and high grade steel tool castings will be manufactured. It is expected that $100,000 bonds will be issued at once, and work commenced on the building this summer. Hamilton and Buffalo capitalists are reported to be interested in the enterprise.

The City Architect of Toronto, Mr. W. W. Pearse, is preparing some amendments to the building by-laws with the object of preventing the erection of any buildings to be used as hotels, no matter what their height may be, unless the specification provides for fireproof construction. Under the existing by-laws unless the proposed building is over 35 feet in height there is no obligation on the part of the builder to render it fireproof. Mr. Pearse announced that it was his intention to protect the travelling public and others in every way possible, and that as far as he could prevent it there would be no firetraps in Toronto.

The new concrete manufacturing plant of the Concrete Builders, Limited, at Gibson, N.B., is said to be one of the busiest industries in that section of the country, notwithstanding that the company was organized and started operations quite recently. An order has been received for 12,000 concrete blocks to be used in the construction of a warehouse, 50 ft. by 80 ft., for the Sumner Company, at Moncton, N.B. Two experts in concrete work, Messrs. H. J. McGrath and T. C. Burpee, C.E., are identified with the management and the company are said to have the only plant of machinery for manufacturing concrete products in the Maritime Provinces.

The Canadian Society of Domestic Sanitary and Heating Engineers closed its convention at Ottawa on June 13 with the election of the following officers: President, G. S. Dorman, Moncton; Vice-President, E. H. Russel, London; Secretary-Treasurer, W. J. Crawford, St. John; Provincial Presidents: Alberta, Joseph Marr, Calgary; Manitoba, A. J. Hammond, Winnipeg; Saskatchewan, N. B. Rowntree, Swift Current; British Columbia, S. A. Wye, Vancouver; New Brunswick, D. J. Shea, Fredericton; Nova Scotia, J. E. Godwin, Halifax; Ontario, F. R. Maxwell, Toronto; Prince Edward Island, B. Shaw, Charlottetown; Quebec, John A. Gordon, Montreal. Next year's convention will be held at St. John, N.B.

Contracts for work involving the expenditure of $230,000 were awarded last week by the Hydro-Electric Power Commission for the dams, canals and penstocks at Eugenia Falls, on the Beaver River, near Owen Sound. Two dams are to be constructed. The contract for No. 1 dam has been awarded to the Ambursen Hydraulic Construction Company of Montreal. This will be one of the largest works of its kind in the Dominion. The dam will be built of reinforced concrete, 2,000 feet long, and with a varying height from 40 to 50 feet. No. 2 dam will be built by Messrs. Hyland, Scribbin & White, of Toronto, and will not be as large as No. 1. Tenders are now being called for the necessary hydraulic and electrical equipment, which will be used to develop 4,000 horse-power, although the headworks, canals and storage reservoir of the undertaking contemplate an ultimate development of 8,000 horse-power.

General business conditions in the Maritime Provinces are in a healthy condition according to a report received from a St. John, N.B., correspondent of the Contract Record. The industrial situation does not show a great deal of activity, but the banks report business satisfactory and real estate values remain firm. In the constructional field the activity in house building is noticeable, building permits issued during May showing an appreciable increase over the same month last year. Many engineering works of considerable magnitude are projected or in progress. At St. John, the harbor development is proceeding vigorously. The new spandrel arch bridge across the Reversing Falls is advancing towards completion. The C. P. R. have had plans prepared for a new steel bridge to be built alongside the new structure and in addition the Dominion Government has undertaken to build two steel railway bridges for the rails of the Valley Railway by which it is expected that the traffic of the G. T. P. will enter St. John. One of these bridges will cross the St. John River and the other the Kennebecasis River.

A new building for the head office of the Bank of British North America was opened a few days ago at St. John, N.B. The site occupied by the new structure is 4,250 square feet and the building has a frontage of 86 feet on Market Square and Dock Street. The construction of the building, which has three storeys and basement, is reinforced concrete, brick and terra cotta. In the basement is a safety deposit vault of drill-proof steel, fitted with triple doors. There are 225 safety boxes, each box requiring three keys to unlock it. The vault was constructed by J. & J. Taylor, of Toronto, and is equipped with time locks and an electric burglar alarm system. In the banking room on the ground floor, terrazzo flooring has been adopted in the public space and arrowlock flooring in the banking space. All the woodwork is of quartered oak and the main staircases of marble. The building is entirely fire-proof. The architects are Messrs. Barrott, Blackader & Webster, of Montreal, Mr. G. E. Fairweather, of St. John, being the associate architect. The general contractors are B. Mooney & Sons. The terrazzo and marble tile work was done by the Dominion Flooring and Tile Company, Montreal.

WESTERN CANADA

The National Paving and Contracting Company, Limited, Winnipeg, have a contract running into $193,000 for asphaltic concrete paving work at Fort William.

A technical school, estimated to cost $300,000, is to be erected at Medicine Hat, Alta. The plans have been drawn and operations are to start as soon as the necessary debentures have been sold.

Sewer contracts amounting to nearly $200,000 have been awarded by the city of Edmonton, the work being divided between C. L. De Vall, the Edmonton Contracting Company and the City Construction Department.

The Alberta Clay Products Company, Medicine Hat, are considering the matter of an extension to their plant. Either they will build a large addition which will double the capacity of the present plant or they will build another plant at Dunmore, Alta.

Construction has commenced on the walls of the Manitoba Parliament Buildings now being erected at Winnipeg at a cost of $2,000,000. The architect is Mr. F. W. Simon and the general contractors are Messrs. Thos. Kelly & Sons, both of Winnipeg.

Edmonton's newest municipally-owned public utility is a paving plant, to be established next month at a cost of $37,000. The entire paving programme for this year involves a total expenditure of more than $1,500,000, part of which will be financed by the Hudson's Bay Company.

The proposed branch line from Round Lake to Girouard, Alta., will not be constructed this year, according to an announcement made by Mr. J. D. McArthur at Edmonton a few days ago. He explained that a charter and guarantee would first have to be obtained from the government before a line could be constructed.

At Edmonton, Alta., good progress is being made on the ten-storey store and office building which is being erected on McDougall Avenue for K. [illegible]

[illegible]. The walls are now up five storeys. The architect is Mr. J. E. [illegible], and the general contractors are Messrs. Olson & Johnson, both of Edmonton.

At Chilliwack, B.C., rapid progress is being made on the Harrison River bridge being constructed by the C. P. R. The structure is made to accommodate double tracks and is 930 feet long. The superstructure is nearing completion, the swing span having been installed and work well advanced from both ends. The Pitt River bridge, a similar structure but one much larger, being 1,750 feet in length, will be the largest of its kind in British Columbia. The swing span is 276 feet in length and weighs 650 tons.

The excavation and grading contract of the Marine & Fisheries site on the Songhees Reserve, B.C., is coming on satisfactorily. The contractors, Messrs. Parks, Tupper & Kirkpatrick, anticipate that the whole of the work will be completed by the end of July. The contract calls for the excavation of about 25,000 cu. yds. of material on the foreshore of the government site, and the construction of a wharf 650 ft. long. Some rock is being encountered in excavating, in connection with which a Marion steam shovel is operating, but it is not anticipated that the presence of rock will seriously effect progress on the contract.

Grading on the British Columbia division of the Canadian Northern Pacific Railway has been completed with the exception of about fifteen miles on the sections between Railhead, 121 miles north of Kamloops, and the terminal of the rails from the eastern end, six miles west of the Yellowhead Pass. Mr. S. H. Sykes, assistant chief engineer of the company, has announced that the bridge over the Canoe river, ten miles east of Albreda summit, has been completed, that construction work will be started at an early date on the bridge over Lion Creek, and that operations are well advanced on the entire section along the North Thompson river.

The whole of the Pacific Great Eastern Railway is now under contract according to Mr. J. W. Stewart, president of the line, who was interviewed recently in Victoria. Grading is in progress along the whole right-of-way from Squamish to Fort George and will practically be finished this year. Mr. Stewart reports that a uniform force of no less than six thousand will be maintained on the work for the balance of the year. In this connection he mentioned that there was this season an ample supply of labor, this condition being mainly due to the fact that the Pacific Great Eastern is the only railway undertaking at present under way in the Province, both the Grand Trunk Pacific and the Canadian Northern Pacific being practically finished.

Constructional activities at Regina are proceeding satisfactorily—so much so, in fact, that there is more building in progress just now than there was at the corresponding time last year. Of the various projects of which we have heard mention may be made of the proposed new office building for the Royal Bank. The Canadian International Light Company, which is capitalized at $100,000, has entered into an agreement with the city of Regina to establish a factory and employ not less than twenty-six hands at the outset. T. A. McAuley, of the Coste-McAuley Syndicate, has been in Regina completing negotiations for the supply of natural gas to the city. The ultimate aim of the syndicate is to supply natural gas to the three largest Saskatchewan cities. There is considerable interest in this project, as it is felt that cheap gas at Regina would prove of inestimable value to local industrial concerns. Mr. A. M. Lloyd, a local architect, has been instructed to prepare plans for a new building for the Regina Labor Temple Company, which is capitalized at $50,000.

Trade Notes

The Link Belt Company, Chicago, in their new book, No. 195, illustrate and describe installations of elevating and conveying machinery for handling newspapers, magazines, and so on, in publishing houses and printing establishments. The cuts are particularly illuminating as to the possibilities of equipment and the book should find its way freely into the hands of engineers, architects and newspaper men.

An effective safety device for the prevention of injury to industrial workers operating power punching presses is described in a booklet just received from Canadian Yale & Towne, Limited, St. Catharines, Ont. The inventor is Mr. R. C. Lewis, of the above company. The device is not patented and it is hoped that it will be adopted largely. It can be installed at small cost and with the exercise of a little ingenuity it can be adapted to any style of press in use.

A booklet devoted to Solvay Granulated Calcium Chloride deals with the efficiency of this product as a dust layer. This product is applied both by machine and hand. For small quantities it can be spread with a shovel and for large areas with a simple spreading machine. When applied to the road it soon becomes incorporated with the surface, which it keeps in a smooth, slightly damp and compact condition. Economy and efficiency are its outstanding claims. The manufacturers are the Semet-Solvay Company, Syracuse.

Many evidences of the efficiency of Ceresit waterproofing are contained in an interesting catalogue just received from the Ceresit Waterproofing Company, Chicago. The catalogue is made up of five booklets, the first being devoted to a scientific explanation of the composition and operation of Ceresit, the second to an enumeration of tests by recognized authorities, the third to a selection of photographs showing where Ceresit has been used, the fourth to testimonials from satisfied users of Ceresit, and the fifth to an explanation of a demonstration test of Ceresit.

Messrs. Wadsworth, Howland & Company, Inc., Boston, announce their removal about January 1, 1915, to more commodious quarters at 139-141 Federal street (Boston). The larger area of floor space covered by these stores will enable the firm to carry under one roof the heavy stock of all goods now carried in their storehouse at 208-210 Milk Street and in their present main store at 82-84 Washington Street, besides giving them excellent facilities for the receipt and delivery of goods. The new location is close to the heart of the shopping and wholesale hardware district and the proximity of the stores of the South Terminal Station is an important advantage. Messrs. Wadsworth, Howland & Company are the manufacturers of Bay State Brick and Cement Coating, a waterproofing material which has already been described in detail in these columns.

American Road Builders' Convention

The proceedings of the Tenth Annual Convention of the American Road Builders' Association (Philadelphia, December 9-12, 1913) comprise a concise record of a meeting of great interest and importance to road-builders and municipalities. A number of the papers were published in the Contract Record shortly after the convention. These are all presented in the Proceedings and are accompanied in each case by the discussions which ensued. Among the interesting features of the Proceedings are the various reports, the revised constitution of the Association, the names of the officers for 1914, and the list of members revised to date. The Secretary of the American Road Builders' Association is Mr. E. L. Powers, 150 Nassau Street, New York City.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Bedford, Que.

The contract for the construction of macadam roads has not yet been awarded by the town council. The tenders were considered unsatisfactory.

Fullarton, Ont.

Tenders close with the township clerk, R. H. Pomeroy, on June 27th, for the dredging of Flat Creek Drain. Plans are at office of the clerk and John Rogers, Mitchell, Ont.

Lachute, Que.

The municipal council has awarded the contract for about 3½ miles of macadam roads, at a cost of $25,950. Work is to start at once. General contractor, C. Charbonneau, Terrebonne, Que.

Lethbridge, Alta.

Tenders have been received for the construction of the subway storm sewers and the contract will be awarded shortly.

Orillia, Ont.

The by-law providing for the raising of the sum of $85,000 to install a filtration plant has been endorsed by the ratepayers.

Ottawa, Ont.

Plans have been drawn by the city council for the construction of the following pavements, at an estimated cost as specified. Murray St. between King and Chapel Sts., wood block 5,145 sq. yds., curb and gutter 2,700 lin. ft., gutter 50 lin. ft., headers 120 lin. ft., $25,800; asphalt and stone block on Somerset St. between Booth St. and Division St., asphalt 1,210 sq. yds., water table 1,360 sq. ft., gutter 680 lin. ft., sandstone blocks 567 sq. yds., $7,800; pavement on St. Joseph St. between St. Patrick and St. Andrew Sts., asphalt 1,090 sq. yds., curb and gutter 22 lin. ft., water table 980 sq. ft., gutter 990 lin. ft., headers 55 lin. ft., $5,000.

The city council proposes to repair the new intake pipe at an estimated cost of $50,000. Arch. Currie, city engineer.

Regina, Sask.

The Canadian Northern Railway Company has secured permission from the city council to lay pavement in the front of the freight sheds on Albert St.

The construction of pavement on Market Sq., at an estimated cost of $10,000, is proposed by the city council.

Richmond, Que.

Tenders endorsed "Proposals for Street Improvements," will be received by E. F. Cleveland, Sec.-Treas. to the town council, until 8 p.m. July 6th, for the construction of bituminous macadam pavement, concrete sidewalks and gutters and crushed stone or gravel macadam streets.

Sandwich, Ont.

The town council has awarded the contract for the construction of reinforced concrete povement to Lenanne Bros., of Detroit, at $40,000.

Tenders will be received by F. D. Brunet, Moose Creek, Ont., until noon July 6, for the construction of Moose Creek drain, including the excavation of 13,564 cu. yds. of earth, etc. Plans, etc., are at the office of the Engineer at Winchester, or with the Clerk. Tenders to state separate price per cu. yd. for earth, hardpan and rock.

The town council proposes to construct reinforced concrete pavement on Askin Ave. at an estimated cost of $3,650.

St. Vital, Man.

Surveys have been made for the construction of sewers at an estimated cost of $8,500. Engineer will make report.

The municipality of St. Vital proposes to construct asphalt on concrete pavement on St. Mary's and St. Ailies Road. Sec., G. J. Charette, St. Vital.

Toronto, Ont.

Tenders close with the Board of Control on July 7th, for the construction of sewers on 13 streets and 5 lanes. Plans, etc., are at the office of Works Dept.

Vancouver, B.C.

Plans have been prepared by the C. P. R. for the construction of a tunnel from Burrard Inlet to the company's yards at False Creek.

Wainwright, Alta.

The construction of a drainage system is being considered by the town council. Mr. E. L. Miles, vice-president of the John Galt Engineering Company, 314 Kennedy Building, Winnipeg, is interested in the project.

Whitby, Ont.

Tenders will be received by the Mayor, J. E. Willis, until 6 p.m. June 29th, for (1) Sewerage, comprising laying and jointing sewers, approximate quantity 8,000 ft. 30 in., 2,800 ft. 24 in., 800 ft. 20 in., 4,500 ft. 12 in., 11,500 ft. 10 in., 28,500 ft. 8in., also the construction of manholes, etc.; (2) Construct sewage disposal works, comprising tanks, filters, pumping station, etc. Plans, etc., and all information at the office of the Consulting Engineers, T. Aird Murray and T. Lowes, 186 King St. W., Toronto.

CONTRACTS AWARDED

Edmonton, Alta.

The following contracts for extensions to the sewerage system have been awarded by the town council: (1) City Construction Dept., Civic Offices, sewers in Inglewood and Westmount, at $91,989; (2) C. L. De Vall, 11 Dominion Block, sewers in North Edmonton, at $46,392; (3) Edmonton Contracting Co., sewers in Highland and Virginia Park at [illegible].

London, Ont.

A contract has been awarded by the city council to Foley & Gleeson, of Central Chmbrs., Ottawa, for the construction of 25,000 sq. yds. asphalt pavement at $2.15 per sq. yd.

Montreal, Que., St. Lambert

The town council has awarded to Thos. Guay, of 33 Church Ave., Cote St. Paul, Montreal, the contract for the construction of 25,000 to 30,000 lin. ft. concrete walks, curbs and gutter, at $38,220.

Regina, Sask.

The city council has awarded to H. Gort, of 922 Garnet St., the contract for the construction of sidewalks at Victoria School.

Prov. of Saskatchewan

The Provincial Board of Highway Commrs. has awarded the following contracts: Ole Howe, of Kandahar, Sask., for the construction of a drain in Twp. 33, Range 10, West 2nd meridian, near Margo, and to C. T. Lount, of 6 MacKenzie Brown Block, Regina, construction of drain in Twp. 27, Range 4, West 2nd meridian.

Sault Ste. Marie, Ont.

The city council has awarded to the Maple Leaf Paving Co. the contract for the construction of 84,000 sq. ft. of cement sidewalks.

St. John, N.B.

The following contracts have been awarded by the city council. B. Mooney & Sons, Queen St., for the laying of pavement on Main St., $26,797.25; R. M. Tobias, 22 Brunswick St., for the construction of the retaining wall, Victoria Sq., $2,015.15.

Toronto, Ont.

The Board of Control has transferred contracts from the Commissioner of Works to the following. A number of asphalt pavements to the Godson Contracting Company, Manning Chmbrs.; sidewalks to H. Mitchell, 464 Brock Ave., Britnell Contracting Company, 209 Davenport Rd., Grant Contracting Company, 50 Front E.; rocmac to the Asphaltic Concrete Company, 74 King E.; concrete pavement to the Riverdale Concrete Paving Co., 256 Jones Ave.

The following contracts for the construction of sidewalks have been awarded by the Board of Control. Ramsay Contracting Co., 39 Indian Rd. Cres., H. Mitchell, 464 Brock Ave., R. J. Moyes & Co., 592 Gerrard St. E., Grant Contracting Co., 50 Front St. E., A. J. Penberthy, 292 Booth Ave., Routly & Summers, 38 Benlamond Ave., A. Johnson, 35 Burgess Ave., Queen City Concrete Paving Co., [illegible] Broadview Ave., Riverdale Concrete Paving Co., 256 Jones Ave., Wm. Bushell, 168 Dundas St., Standard Concrete Paving Co., 74 Moscow Ave.

The Board [illegible]

following paving contracts to the Commissioner of Works: A. C. Harris, Asphalt on Conduit, Dupont, Humberside, [illegible] Wellington, Webster, [illegible] asphalt concrete on First Ave., [illegible] to Dufferin St. and Jubilee Ave., [illegible] concrete curbings on [illegible] St., Payne and Quebec Aves., concrete sidewalks on Eastern, Hadley, [illegible] and Quebec Avenues. The work will be done by day labor.

Vernon, B.C.

The city council has awarded to the local firm of H. C. Ogilvie, the contract for the construction of concrete walks.

Welland, Ont.

The town council has awarded the contract for the construction of concrete sidewalks to Chester Johnson, Ridgeway at 11c per foot.

The Welland county council has awarded to the Standard Crushed Stone Co., of Niagara Falls, the contract for the construction of 34 miles of roads. The contracting company will lay the roadway, and the county authorities will do the grading.

Winnipeg, Man., Transcona

The contract for the construction of the outlet sewer has been secured by A. C. Vanhorenbeeck & Co., of St. Boniface.

The following additional contracts have been awarded in connection with the sewage and water system. (5) Thos. Jackson & Sons, 370 Colony, Winnipeg, for 5-in. to 24-in. vitrified sewer pipe; Canadian Lockjoint Pipe Co., 7th Ave., Regina, Sask., for 30-in. to 36-in. vitrified sewer pipe.

Railroads, Bridges and Wharves

Calgary, Alta.

The city council will call for tenders in about 6 weeks for the construction of a reinforced concrete bridge and two docks at Centre St., at a cost of $750,000; also a reinforced concrete and steel bridge on 9th street, at a cost of $225,000. Engineer, Geo. W. Craig.

Hawkesbury, Ont.

Tenders will be received until July 14 by R. C. Desrochers, Sec. Department of Public Works, Ottawa, for approaches and substructure for bridge, including abutments, roadway and sidewalks, across Ottawa River. Plans are at the office of the Department, Dist. Engineers, Montreal and Toronto, and Postmaster, Hawkesbury; specification is at the office of MacLean Daily Reports Ltd., 220 King St. W., Toronto.

Quebec, Que.

The Limoilou Land Co., Ltd., c/o Pacaud & Morin, Attorneys, have filed plans for wharf to be constructed on St. Charles River between Drouin and Dorchester Bridges.

Regina, Sask.

Plans are being drawn for the construction of a bridge over Wascana Creek. Engineer, F. McArthur, City Hall.

The Grand Trunk Pacific Rly. are contemplating the construction of a spur track from G. T. P. and street railway tracks at intersection of 5th Ave. J. P. Kirkpatrick is the engineer in charge.

St. Alphonse, Que.

The construction of a wharf at an estimated cost of $25,000 is proposed by the Roberval-Saguenay Railway. Tenders will be called next month. Engineers in charge, Grenon & Lavoie, Chicoutimi.

Toronto, Ont.

The York township council will receive tenders until noon July 6th, for the construction of a concrete truss bridge over the Don River, near Schmidt's Mill. Plans and specifications are at the office of the engineer in charge, Frank Barber 57 Adelaide E., who will receive tenders.

Tenders close with the Board of Control July 7th, for the construction of concrete abutments, retaining walls and bridge floor at Strachan Ave., Toronto. Plans are at the office of the Railway & Bridge section, City Hall. Toronto Harbor Commissioners contemplate the erection of a foot bridge over the G. T. R. tracks at the foot of Wilson Ave.

Woodstock, Ont.

Tenders will be received by the County Clerk, N. E. Birtch, Court House, until 10 a.m., June 27th, for the supply and construction of abutments and steel superstructure for a 40 ft. span over Horners Creek.

CONTRACTS AWARDED

Arthur Township, Ont.

The following contracts for the construction of a number of small bridges and culverts have been awarded by the township council. R. Baths, of Kenilworth for concrete work at $5.00 per cubic yard and 23 cents per square foot for floors. Alex. Hill, of Mt. Forest, for iron work.

Pritchar, B.C.

The contract for the construction of a Government wharf has been awarded to H. S. Bahara & Samuel Mills, 1029 Fifth Ave., New Westminster.

Quebec, Que.

The Transcontinental Rly. Commissioners have awarded the contract for a new station at Champlain Market, to Jos. Gosselin, Levis, Que.

Simcoe County, Ont.

The county council has awarded to J. O. Coates, of Orillia, the contract for the construction of concrete bridge abutabutments.

Sudbury, Ont.

The Temiskaming & Northern Ont. Rly. Commsn., Toronto, has given the contract for the construction of 3 stations and 5 section houses to Sherwood & Sherwood, Sudbury and Toronto. The buildings will be concrete and frame construction.

Toronto Ont.

The Crawford St. bridge contract has been awarded by the Board of Control to Wilson, Townsend & Saunders, of 79 Spadina Ave.

Public Buildings, Churches, Schools, etc.

Bowmanville, Ont.

Tenders will be called shortly by the Public Works Department for the erection of an armory at an estimated cost of $20,000.

North Battleford, Sask.

Plans for the erection of a city hall, at the junction of 2nd Ave. and King St., are about to be prepared by the city council.

A site at the corner of 2nd Ave. and Henry St., has been selected by the city council for the erection of a fire hall.

Burford, Ont.

Tenders for the erection of a post office, on King St., will be received by R. C. Desrochers, Public Works Dept., Ottawa, until 4 p.m. July 8th. Plans, etc., are at the office of Thos. Hastings, Clerk of Works, Postal Station "F," Toronto Post Office, Burford, and at the Dept., Ottawa.

Charlottetown, P.E.I.

Foundations are going in for the sanitarium to be erected at Charlottetown, P.E.I., at a cost of $30,000, for the Prov. Govt. General contractor, J. M. Clark, Water St., E. Summerside, P.E.I.; the following sub contracts have been let: Heating, Jas. McEachern, 34 Upper Queen St., $4,755; plumbing, Stanley, Shaw & Peardon, Great George St. Tenders are open for electric and interior fittings. Communications to be addressed to Chas. Dalton, Sanitarium Commsn.

Cobourg, Ont.

The Public Works Department proposes to make certain additions to the post office at an estimated cost of $25,000.

Calgary, Alta.

Tenders for the erection of a children shelter, on Harvetta Heights, are about to be called by the city council.

Tenders for the erection of a church, on Mt. Pleasant, for the Roman Catholic denomination are invited by the architect, Chas. H. Hay, Oddfellows Bldg.

Cobalt, Ont.

Tenders for the erection of a school building for the Public School Board, will be received by the Sec.-Treas., John Leigh, until June 27th, estimated cost $7 000. Architects, Angus & Angus, of North Bay, Ont.

Cochrane, Ont.

Plans for the erection of a school building are being drawn for the Public School Board, by Angus & Angus, of Main St., North Bay. The cost is estimated at $30,000.

Duncan, B.C.

Plans for the erection of a courthouse, at a cost of $40,000, have been drawn for the Public Works Dept., by Coates & Fleet, of Winch Bldg., Fort St., Victoria. Tenders will be called shortly.

Edmonton, Alta.

The purchase of equipment for the King Edward Technical School, at a cost of $5,000 has been authorized by the Director of Technical Education.

It is understood that the erection of the $100,000 club house for the McDougall Methodist Congregation will not be proceeded with this year.

Elfros, Sask.

Tenders for the erection of a 4-room school building will be received by the architects, Munroe & Mead, of Yorkton, Sask., till July 3rd. Estimated cost $18,000.

Esquimalt, B.C.

Plans for the erection of a city hall, at a cost of $22,000, have been drawn by Thos. D. Sedger, of 512 Bastion St., Victoria. A by-law will be submitted shortly.

Hamilton, Ont.

Plans are in progress for the erection of a 2-storey school of brick construction, stone foundation, at a cost of $25,000. J. A. Armes, Federal Life Bldg., is the architect.

The date for taking the opinion of the ratepayers on the East end library question has been changed to July 8th.

Tenders for alterations to Barton St. Hospital will be received by the architects, Stewart & Witton, 7 Hughson St. S. until June 30th.

Tenders will be received by R. Foster, City Hall, Sec. to the Board of Education, until June 26th, for installation of heating and ventilating system in "Ryerson" school, also for the erection of a new boiler house. Architects, Stewart & Witton, Provident Bldg.

Plans are being drawn for certain additions to the Aged Womens Home, Wellington St. S., at a cost of $25,000. Architects, Mills & Hutton, Bank of Hamilton Bldg.

Plans for the erection of a 16-room public school, on Homewood Ave., are being drawn by Stewart & Witton. Provident Bldg. A site has been purchased and tenders will be called shortly. Estimated cost $100,000.

Plans for the erection of a 12-room public school, on Wentworth St. N. are being prepared by A. W. Peene, of the Clyde Block. A site has been purchased, and tenders will be called shortly. The estimated cost is $80,000.

Hampton, N.B.

Tenders for interior fittings at the post office will be received by R. C. Desrochers, Public Works Dept., Ottawa., until 4 p.m., July 2nd. Plans and specifications are with Postmaster, Hampton, D. H. Waterbury, Clerk of Works, St. John, N.B., and at the Dept., Ottawa.

Kingston, Ont.

Tenders for the interior decoration of Cooke's Church will be received by the secretary J. W. Bradshaw, Court House.

Listowel, Ont.

The contract for the erection of a drill hall, 2-storeys and basement, 106 x 62, concrete and steel, brick construction, has been let by the Dom. Govt. Dept. of Public Works to W. A. Tom Constr. Co., Ltd., Collingwood, Ont.

Manitou, Man.

Tenders for the erection of a public building will be received by R. C. Desrochers, Public Works Dept., Ottawa, Ont., until 4 p.m. July 13th. Plans, etc., are at the Post Office, Manitou, [illegible] H. E. Matthews, Supt. Architect, Dominion Public Bldgs., Winnipeg, Post Office, Brandon, and at the Dept., Ottawa.

Medicine Hat, Alta.

Plans have been drawn for the erection of a technical school, at a cost of $300,000. Work is to start as soon as the necessary debentures are sold.

Milton, Ont.

The Dom. Govt. Dept. of Public Works has awarded the contract for the construction of a post office, 2½-storeys and basement, 48 x 52, cut stone, steel and brick, to Samuel Heusen, Box 214, Milton, Ont.

Montreal, Que.

Mr. Lucas, of City Hall, has been appointed architect in connection with the proposed erection of city stores and garage.

Plans are being drawn for the erection of a club house on Dufferin and Logan Sts., at a cost of $50,000. The architect, J. A. Ouellet, Dandurand Bldg., will call tenders shortly.

Montreal, Que., Notre Dame de Grace

Work on the new St. Columbia Church will not be started until the Fall.

New Hazelton, B.C.

Tenders for the erection of a public building will be received by R. C. Desrochers, Public Works Department, Ottawa, until 4 p.m. July 15th. Plans, etc., are at the office of Mr. Wm. Henderson, Res. Architect, Victoria, Post Office, New Hazelton, the office of the Dist. Engineer, Public Works Dept., Prince Rupert, and at the Dept., Ottawa.

Oak Bay, B.C.

The municipal council proposes to expend the sum of $35,000 on the erection of city stables. The ratepayers will be asked to endorse the project.

Palmerston, Ont.

New tenders on the erection of a public building, on Bell and William Sts., will be received by R. C. Desrochers, Public Works Dept., Ottawa, until 4 p.m. July 7th. Plans, etc., are at the office of Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Postmaster, Palmerston, and at the Dept., Ottawa.

Parry Sound, Ont.

Plans for the erection of a Sunday School for St. Andrews Presbyterian Church, have been drawn by H. Simpson, 13 Wellington E., Toronto, Ont. Tenders are not called yet.

Point Grey, B.C.

The Board will receive plans for construction of an 8-room fireproof school. Further particulars can be had from the secretary.
secretary. Frank Peace, Municipal Hall, Kerrisdale.

Prince Rupert, B.C.

Tenders for the erection of an 8-room school will be called shortly. J. E. Gilmore is the architect.

Red Deer, Alta.

Tenders for the erection of a public building on 1st avenue will be received by R. C. Desrochers, Public Works Department, Ottawa, Ont., until 4 p.m., July 15th. Plans, etc., are at the office of:—C. A. Julian Sharmam, Barnes & Gibbs, Architects, Red Deer; Postmaster, Brandon, Man., and at Department, Ottawa.

Regina, Sask.

The Provincial Dept. has sanctioned the purchase of a site in Block 26, Premier Place, for the erection of a 6-room school.

Plans are being prepared for the erection of a labor temple, on Lorne and 13th Aves. A. M. Lloyd (Post Office Box 693), is the architect.

Seaforth, Ont.

The Salvation Army authorities have not yet decided if the old barracks will be remodelled or a new building erected.

St. Catharines, Ont.

Plans for the Salvation Army citadel are about completed, and tenders will be called for shortly. Architect, Major G. Miller, Albert St., Toronto.

St. John, N.B.

The Salvation Army authorities propose to remodel the Pitt St. Home, and erect a new maternity hospital. Plans are now being prepared by the architect, Major Miller, Albert St., Toronto.

Sandwich, Ont.

The town council has plans in progress for the erection of a fire hall at a cost of $10,000, and the ratepayers will shortly vote on a by-law.

Truro, N.S.

Tenders will be called in the near future for the construction of a stone and brick school, at a cost of $40,000, for the School Board.

Toronto, Ont.

Tenders will be received by R. C. Desrochers, Dept. of Public Works, Ottawa, until 4 p.m. July 13th, for the erection of a postal station on Spadina Ave. and Oxford St. Plans, etc., are at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, and at the Dept., Ottawa.

Tenders for all trades for mid summer repairs for the Separate School Board close July 6th. Plans are at office of the Architect, C. J. Read, 203 Confederation Life Building.

The construction of a central incinerator and reduction plant to be located in Ashbridges Bay district is contemplated by the Board of Control.

Bulk or separate tenders for additions to Brown, Frankland, and Morse St. Schools will be received by the Sec.-Treas. to the Board of Education, until June 26th. Specifications, etc., are at office of the Superintendent of Buildings, City Hall.

Trenton, Ont.

Tenders for interior fittings at the post office will be received by R. C. Desrochers, Public Works Dept., Ottawa, until 4 p.m. June 30th. Plans, etc., are with Mr. John Potter, Caretaker, Trenton, T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, and at the Dept., Ottawa.

Truro, N.S.

Tenders for the erection of a science building, on Bible Hill, will be received by M. Cunning, Pine Agricultural College, until noon July 1st. Architect, S. P. Dumaresq, St. Paul Bldg., Halifax

Vancouver, B.C.

Plans are to be prepared by the Public Works Department for the construction of a grain elevator estimated to cost $750,000 to $1,000,000

Victoria, B.C.

Plans for the erection of an office building for the Dom. [illegible]

(Continued on page 80)

Tenders and For Sale Department

Tenders for Construction of Sidewalks

[illegible] of Monday, July 6th, 1914, for the construction [illegible] Avenue, [illegible] Avenue, [illegible] Avenue and Jane Street in the Township of York.

[illegible] undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.

Toronto, June 22, 1914 25

Notice to Contractors

[illegible] by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, July 7th, 1914**, for the construction of the following Sewers, viz.:—

Alton Avenue drainage system outlet from Ashbridge's Bay to Alton Avenue and Doel Ave. via Laing Street, Queen Street and Alton Ave.

Berkeley Place, Edgewood Ave. to James Pl.

Davenport Road, Lightbourne Avenue to St. Clarens Avenue.

Florence Avenue, 413 feet west Hemlock Ave. to 253 feet east Hemlock Ave.

Hammersmith Ave., Ilesworth Avenue to Glenmanor Drive west.

Humberside Ave., Mavety St. to Medland St.

Isleworth Avenue, Glenmanor Drive to 250 feet east of Hammersmith Avenue.

James Place, 100 feet south Berkeley Place to 100 feet north Berkeley Place.

Lane 1st east Church Street, N.S. Wood St. to S.S. Maitland Street.

Lane 1st west Roncesvalles Avenue, Garden Avenue to Galley Avenue.

Lane 1st north Springhurst Avenue, Cowan Avenue to Dunn Avenue.

Lane 1st west Yonge Street, Gerrard Street to Hayter Street.

Lane 1st west Yonge Street, N.S. Hayter St. to north end.

North Place, Berkeley Place to north end.

Pinehurst Avenue, W.S. Bellefair Avenue to [illegible]

Queen Street, 40 feet east Coxwell Avenue to 425 feet further east.

Street 1st north College street, E.S. Crawford Street to W.S. Montrose Avenue N.

Williamson Road, Glenmanor Drive West to E.S. Wineva Avenue.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties, approved of by the City Treasurer, or in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid. Conditions relating to tendering as prescribed by city by-law must be strictly complied with. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.

Toronto, June 17th, 1914. 25

To Contractors

Sealed separate or bulk tenders will be received by the undersigned up to noon of **Tuesday, June 30th, 1914**, for all trades required in the erection of a residence in Balmoral Avenue, Toronto.

The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the office of

F. S. BAKER, Architect,
Traders Bank Bldg.,
Toronto, Ont.

25

Notice to Contractors

Tenders will be received until **10 o'clock Saturday, June 27, 1914**, for the dredging of the Flat Creek Drain in the Township of Fullarton, County of Perth.

A marked cheque representing 10 per cent. of the tender must accompany each. Plans and specifications may be seen at the office of Mr. John Roger, O. L. S. Mitchell, or at the Clerk's office, Fullarton.

R. H. POMEROY,
Township Clerk.

25

Sealed tenders addressed to the undersigned, and endorsed "Tender for Bridge Substructure and Approaches at Hawkesbury, Ont.," will be received at this office until 4.00 p.m., on **Tuesday, July 14, 1914**, for the construction of Substructure and Approaches for an Interprovincial Highway Bridge across the Ottawa River at Hawkesbury, Prescott County, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Shaughnessy Building, Montreal, P.Q.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Hawkesbury, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 13,1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—62663. 24-25

TENDERS

TOWN OF WELLAND

Pavements

Tenders addressed to the undersigned and marked "Tender for North Main Street Pavement," will be received until 4 p.m. on the **Second day of July, 1914**, for approximately 6,200 square yards in Vitrified Brick, Reinforced Concrete or Bitulithic, which is divided into 1,400 square yards of Street Railway Track construction and 4,800 square yards of side construction with curbs, etc.

Plans and specifications may be seen at the office of the Canadian Engineer, 62 Church St., or office of the Contract Record, 220 King Street West, Toronto. Plans and specifications, etc., may also be seen at office of Town Engineer, Welland, where tender forms and all other information may be received.

Sealed tenders fully endorsed must be accompanied with an accepted bank cheque valued at 10 per cent. of tender price.

The Council do not bind themselves to accept the lowest or any tender.

C. M. WEBBER, Town Clerk,

Welland, June 20th, 1914. 25

Department of Railways and Canals, Canada

Welland Canal

Stone Protection on Summit Level between Thorold and Port Colborne

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Stone Protection on Summit Level between Thorold and Port Colborne, Welland Canal," will be received at this office until 16 o'clock on **Friday, June 26th, 1914**.

Specifications and form of contract to be entered into can be seen at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, St. Catharines, Ont.

An accepted bank cheque for the sum of $1,500, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.

Department of Railways and Canals,
Ottawa, June 8th, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—62751. 24-25

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Palmerston, Ontario," will be received at this office until 4 p.m. on **Tuesday, July 7, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., the Postmaster, Palmerston, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 13, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63099. 24-25

Tenders for Dredging

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Dredging, McKellar River," will be received until 4 p.m., Friday, **July 3rd, 1914**, for dredging required at McKellar River, Fort William, Ont.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The Dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of the filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender [illegible] order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 19, 1914

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 63370. 25-26

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Postal Station "E," Toronto, Ont.," will be received at this office until 4 p.m. on **Monday, July 13, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 17, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 15794 25-26

Orillia Water, Light & Power Commission

Town of Orillia, Ontario

Waterworks Extensions

Notice to Contractors

Sealed tenders will be received by the Secretary of the Orillia Water, Light and Power Commission, Orillia, Ontario, for the following works:—

Until 9 a.m. Monday, July 13th, 1914.

[illegible]

Contract "B"1 Constructing reinforced concrete [illegible]

Contract "B"2 Constructing brick pump house.

Contract "C"1 Furnishing cast iron water pipe [illegible]

Contract "C"2 Furnishing steel water pipe and specials.

[illegible] rants.

Contract "K" Laying of Intake pipe in Lake [illegible]

Until 9 a.m., Monday, July 27th, 1914.

[illegible] driven turbine pumps and equipment.

[illegible]

Contract "G" Furnishing and erection of Mechanical Pressure type filtration plant.

Tenders shall be sealed and plainly marked on [illegible] the case may be. The Commission reserves the right to reject any or all tenders or to call for [illegible] be in the interests of the Town of Orillia.

[illegible] after July 6th, 1914, at the office of the Canadian Engineer, Toronto, and at the Commission office Orillia, Ont.

[illegible]

W. K. GREENWOOD, B.A.Sc.,
[illegible]

Laying Intake

Sealed tenders marked "Tender for Laying Intake," will be received by the Clerk of the Municipality of New Toronto up to **July 4th, 1914**, for the laying of a steel intake pipe.

Plans and specifications with forms of tender may be seen at the office of the Engineers, Messrs. James, Loudon and Hertzberg, 79 Adelaide Street East, Toronto.

GEO. IRONSIDES, Reeve.
25 GEO. SCOTT, Clerk.

TENDERS

New Registry Office at Milton, Ont , for County of Halton

Tenders will be received until 12 o'clock noon July 6th, for general or separate trades required in the erection of a fireproof Registry Office for the County of Halton at Milton, Ont.

Plans and specifications can be seen at the office of Wm. Panton, County Clerk, Milton, or at office of the undersigned.

Tenders shall be sent to undersigned, sealed and plainly marked on outside "Tender for "Registry Office."

Tenders shall be accompanied by marked cheque for 5 per cent. of their amount.

Cheques will be returned to unsuccessful bidders immediately following the opening and consideration of tenders.

Other cheques will be held as a guarantee of the completion of the contract instrument by the tenderer.

GEO. N. MOLESWORTH,
GORDON M. WEST,
Associate Architects.
2 College Street,
25 Toronto, Ont.

TOWN OF ST. LAMBERT, P. Q.

SEWERS

Sealed tenders will be received up to 6 p.m., **July 6th, 1914**, for the installation of Storm and Sanitary Sewers, Street Gulleys and Manholes.

Plans may be seen and specification and tenders may be had on application at the office of the Town Engineer on or after June 26th, 1914.

The Town reserves the right to divide the work into two or more contracts and reject any or all tenders.

(Signed) [illegible] DRINKWATER
25 Town Engineer

Wanted To Purchase

[illegible] capacity, with or without cables.

For Sale

[illegible] chines with pallets.

[illegible] F. W. HOARE
24-25 St. Catharines, Ont

For Sale

[illegible] Debentures; 30 yearly equal instalments of principal and interest. Interest at five per cent per annum.

[illegible] will be received until noon, the 30th inst. The [illegible]

N. E. BIRTCH, County Clerk.
[illegible]

For Sale

[illegible]

THE [illegible] COMPANY,
[illegible] Hamilton, Ont.

Gas Engine For Sale

[illegible] by 8-in. face. This engine is now [illegible] be used with natural gas, but can [illegible] to use with gasoline at a very rea-[illegible] plant. It has been used while our plant was [illegible] construction. Our power plant is now com-[illegible] we have no further use for this engine. [illegible] is a Leader Iron Works make and [illegible] without duty or cost of instal-[illegible] our shop for $825 f.o.b. our plant. Partial payments considered.

H. MUELLER MFG. CO., LTD.,
[illegible] Sarnia, Ont.

Public Buildings, Churches, Schools, etc.

(Continued from page 77)

ver, have been drawn by H. S. Griffith, [illegible] Vancouver.

North Vancouver, B.C.
W. J. Smith, Limited, of 602 Hastings Street West, who has the general contract for the new central school, is open for sub-tenders.

CONTRACTS AWARDED

Aylmer, Ont.
The contract for interior fittings at the post office and customs house has been awarded by the Public Works Department to J. T. Schell, Co., Ltd., of Alexandria, Ont.

Dartmouth, N.S.
The following contracts have been awarded by the school board. Greenvale School: General contractors, Rhodes Curry Co., Amherst, N.S., plumbing and ventilating, J. J. O'Toole, 129 Ochterloney St., Dartmouth, at $2,960, also electric wiring at $128, heating, Longard Bros., 213 Hollis St., Halifax, at $3,493, electric wiring, J. Starr & Sons Co., Ltd., 158 Granville St., Halifax, $145, painting, Harrison Bros., 54 Barrington St., Halifax, at $1,760. Hawthorne School: General contractors, Rhodes Curry Co., Amherst, N.S., plumbing and ventilating, J. J. O'Toole, 129 Ochterloney St., Dartmouth, at $2,987, also electric wiring at $128, heating, Longard Bros., 213 Hollis St., Halifax, at $3,965, painting, Harrison Bros., 54 Barrington St., Halifax, at $1,760.

Edmonton, Alta.
The library contract has been awarded by the city council to the local firm of Brown & Hargreaves.

Hamilton, Ont., Waterdown
The contract for the erection of the R. C. Church has been secured by Slater & Copp, Waterdown.

Halifax, N.S.
J. W. Kedy, of 138 Cunard Street, has secured the contract for the erection of a hall for the Acadia Lodge of the L. O. L.

Hamiota, Man.
A. Bostrom, of 255 Pritchard Ave., Winnipeg, has secured the contract for the erection of the new Methodist Episcopal Church.

Humboldt, Sask.
The court house contract has been awarded by the Public Works Department to the Parsons Construction & Engineering Co., of Regina.

Kemptville, Ont.
The contract for post office fittings has been let by the Public Works Department to J. T. Schell Co., Ltd., of Alexandria, Ont.

Montreal, Que., Notre Dame de Grace
A contract for the erection of a school has been awarded by the School for the Blind, Sherbrooke St. W., to the Lumber & Constr. Co., of Ville St. Pierre.

North Bay, Ont.
The following contracts have been awarded on the Worthington St. School. General contractor, H. Marceau, 237 1st Ave.; heating and plumbing, Farrel Engineering Co., 138 McIntyre St.; electrical, Burrous & Parmalee, Ferguson St.

Paisley, Ont.
The school contract has been awarded by the Public School Board to H. Ackerman, of Harriston.

Port Arthur, Ont.
The following contracts have been awarded on the market building, Van Norman St., by the city council. General contractors, Pt. Arthur Contractors, Ltd., $9,782; Seaman & Penniman, Room 17, Graham & Horne Block, for sheds, iron frame, covered with metal, $2,182.

The police station contract has been secured by George H. Otto, of St. Paul street.

Port Coquitlam, B.C.
The following contracts have been awarded on the erection of the central school. General contractors, Coquitlam Constr. Co., $13,478.20; plumbing, Coquitlam Hardware Co., $1,330; heating, Dunsmore & Sweeney, $1,675. The Johnson temperature regulator appliance is to be installed.

Regina, Sask.
The contract for the construction of wooden sidewalks has been let to Gibson & Harwood, of Winnipeg. The general contractors are to supply lumber, and the work will be done by day labor.

The Otis-Fensom Elevator Co. has secured the contract for the installation of an elevator in the new wing of the Isolation Hospital.

Shoal Lake, Man.
The church contract has been let to E. R. Snider, of Chestnut St.

Toronto, Ont.
The contract for additions to St. Johns Presbyterian Church, Broadview and Simpson Aves., has been let to John Anderson, 28 Hamilton Street.

North Vancouver, B.C.
The contract for the erection of the central school on Keith Rd. and 8th St., has been secured by W. J. Smith, Ltd., of 602 Hastings W., Vancouver, $116,112.

Welland, Ont.
The contract for alterations and addition to the registry office, has been awarded by the county authorities to Ryan & Gardiner, Welland, $18,415.

Welland Jct., Ont.
The public school contract has been let by the School Board to Ireland & Deniham, of Welland Jct.

Winnipeg, Man., Transcona
The fire hall contract has been secured by Tonpin Bissonet, of St. Boniface, Man.

Business Buildings and Industrial Plants

Aylmer, Que.
Work has started on the construction of a sawmill at a cost of $30,000, for the owner and general contractor, T. Ritchie Co., Mill St. The building will be concrete foundation, frame and brick veneer construction, corrugated iron roofing, electric lighting, pine floors, woodworking machinery.

Brantford, Ont.
Plans for the erection of a $30,000 factory, at the cor. Rawdon St. and Park Ave., are being prepared for the Brantford Industrial Realty Co., by Barber & Tilley, Temple Bldg., who will call for tenders about June 30th.

Camrose, Alta.
The plans for the erection of a hotel for the Calgary Brewing Company are being altered and work will not start until next summer.

Camrose, Alta.
Tenders for the erection of a store for A. Carruthers, Main St., will be received from September 1st to 15th.

Edmonds, B. C.
Plans for additions to the premises of the Acorn Lumber Company are being prepared.

Galt, Ont.
It is understood that the Galt Ornamental Iron Company may build a new factory.

Hamilton, Ont.
Plans for public garage, on King St. E., have been drawn by the A. Bell Co., Clyde Block. Private tenders will be called shortly.

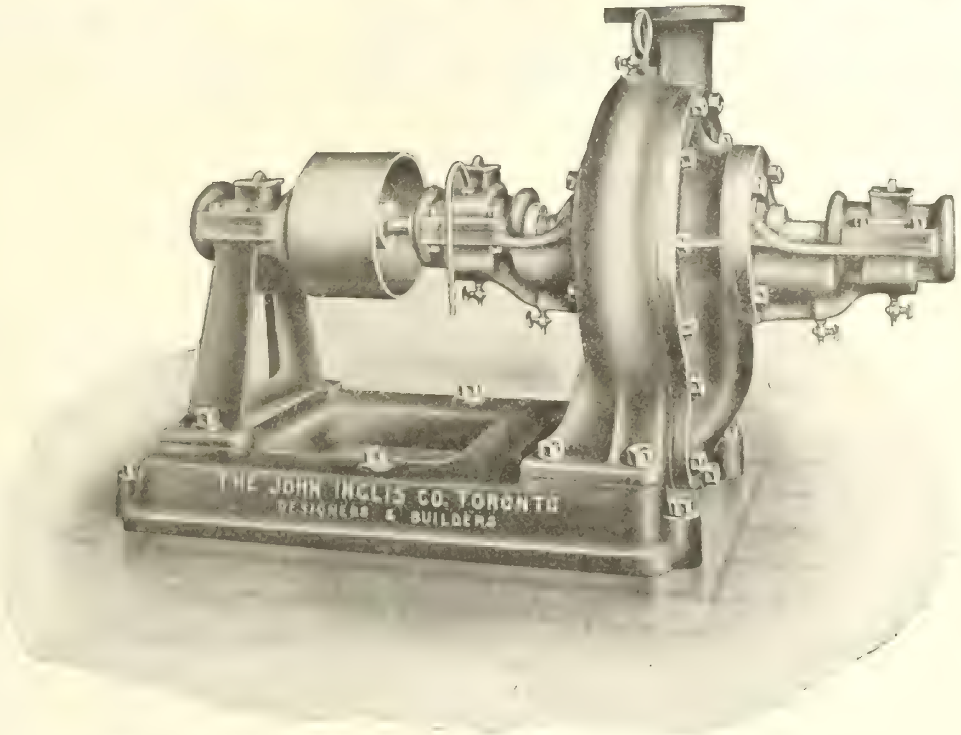
Plans for the erection of a factory on Margaret St., for the McGregor Shirt Co. have been drawn by F. J. Rastrick & Son, 30 King St. E.

Plans for the erection of a moving picture theatre, on Sherman Ave., are being prepared by Stewart & Witton, Provident Bldg.

Montreal, Que.
New tenders have been called for additions and alterations to an hotel, at a cost of $15,000, for Mrs. Martin, 109 Windsor St. The owner is receiving prices for the general contract. Danl. J. Crighton, Jacobs Bldg., is the architect.

Plans have been altered for the erection of a garage and stable on Cedar Ave., at a cost of $35,000, for Lt.-Col. W. W. Burland, Pine Ave. Tenders will be invited

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

shortly by the architect, D. J. Spence, 10 Beaver Hall Hill.

Separate tenders for alterations to stores on Jacques Cartier Sq., will be received by the architect, Theo. Daoust, 26 St. James St., until June 30th.

It is understood that competitive plans for the erection of a $200,000 theatre will shortly be invited by Maurice Wolff, of 130 Peel St.

Montreal, Que., Cote des Neiges

A. F. Byers & Co., 340 University, are taking prices on roofing, plastering, painting, heating plumbing, electric and interior fittings in connection with the construction of a Winter tennis court at Cote des Neiges, at a cost of $25,000. Harold E. Shorey, 56 Beaver Hall Hill, is the architect.

Ottawa, Ont.

The erection of stores and apartments on St. Patrick St., at a cost of $45,000, is proposed by Jacob Morris, 254 St. Patrick St.

J. Moxley, of 172 Cartier St., contemplates the erection of a picture house at the corner of Somerset and Rochester streets.

Qu Appelle, Sask.

The Troy Rural Telephone Co., has awarded the contract for the construction of a telephone system to G. T. Brander, Wolsley, Sask.

Regina, Sask.

The Metal Shingle & Siding Co., of Preston, Ont., will shortly erect a warehouse here. A temporary building is erected for the present.

Schumaker, Ont.

Additions to the mining plant of the McIntyre Porcupine Gold Mines, Ltd., are being considered. A decantation plant is to be established to increase the capacity by 150 tons.

St. John, N.B.

Work on the erection of the Mill and Main Sts. Branch of the Bank of Nova Scotia will not be started until May 1st, 1916. Architect, F. Neil Brodie, 42 Princess street.

Toronto, Ont.

A permit for the erection of a detached garage on Dalhousie street has been granted to the Daily Star Company, Limited, 18 King St. W.

Plans for the erection of six stores and apartments on Queen Street and Erie Terrace, at a cost of $20,000, are being drawn by J. M. Cowan, 65 Adelaide E.

Plans for the erection of a warehouse on John St., for F. S. Thomas, 61 Albert St., have been drawn by S. L. Yolles, 16 Madison Ave.

Tenders for alterations to store, etc., on Yonge & Elm Sts., are invited by the architect, N. G. Beggs, 12 Cosgrave Bldg.

The Cosgrave Brewing Co., of 293 Niagara St., have under consideration certain additions to their premises.

The erection of a store and office building on Yonge St., is proposed by Chas. Tugman, 88 Yonge St. The building is to be occupied by the Walkover Shoe Co. of Montreal. Estimated cost, $40,000.

Wallace & Cummings, 1003 Lumsden Bldg., who has the contract for the construction of a condenser for Neilsons, Ltd., at Beechville, is now open for tenders on tile work, labor only, also for tenders on stucco and plaster work and tar and gravel roofing.

Vancouver, B.C.

A permit for the erection of stores and apartments on 10th and Main Sts., at a cost of $20,000, have been granted to McPherson & Fullerton Bros., 616 View, Victoria. Architect, Jesse M. Warren, 503 Central Bldg., Victoria. General contractors, B. C. Constr. & Engineering Co., 520 Central Bldg., Victoria.

Winnipeg, Man.

Plans are being drawn for the erection of a warehouse on Curtis St., for the Farmers Supply Co., Bannatyne Ave. The estimated cost is $45,000.

CONTRACTS AWARDED

Caledonia, N.S.

The contract for the erection of an apple warehouse for the North Queen's Fruit Packing Co., has been secured by J. H. Hicks & Sons, of Bridgetown, N.S.

Galt, Ont.

The following contracts have been awarded on extensions to The Imperial Hotel, Water St. S. Brick work and masonry, Jas. S. Webster, Crombie St.; carpentry, Wm. Hart, John St.

Halifax, N.S.

The following contracts have been awarded on the erection of a drug store and apartments on Robie St. and Spring Garden Rd., for G. A. Burbidge. General contractors, Thomson & Theakston, 116 Hollis; heating, plumbing and electrical, Farquhar Bros., Ltd., 16 Barrington St.

Hamilton, Ont.

The following additional contracts have been awarded on the Molsons Bank Building. Carpentry, J. Huckson, 147 Belview Ave., roofing, Riddle & Son, 16 Ferguson St. N.; plastering, Hannaford Bros., 232 Robinson St.; painting, J. Boswell, 44 Victoria Ave. S.; heating and plumbing, A. Clark, 7 Main St. W.

New Westminster, B.C.

The contract for the erection of a cold storage warehouse for the St. Mungo Cold Storage Co. has been secured by W. Hayman, Sapperton, B.C., $16,500. A $40,000 plant will be installed.

North Bay, Ont.

Chamberlin Bros. have secured the contract for the erection of stores and apartments on Oak St. for I. Caplan.

The contract for the erection of stores on Oak St., for H. H. Thompson, has been let to Chamberlin Bros.

The contract for the erection of a business block, on Main St., for S. J. Cherry, has been secured by D. Barker, 2nd Ave.

Saskatoon, Sask.

The contract for the construction of a plant for the Saskatchewan Cold Storage Co., Ltd., has been let to Frid Lewis & Co., of 901 Somerset Bldg., Winnipeg.

Sudbury, Ont.

The contract for the erection of a hotel building on Elm St., for D. M. Morin, White House, has been let to the Labarge Lumber Co., Stobie Rd.

St. Andrews, N.B.

The sub contract for woodwork, etc., in connection with the repairs to the C. P. R. Hotel has been secured by Murray & Gregory, of Douglas Ave., St. John, N.B.

Vancouver, B.C.

The contract for the erection of a hotel on Main St., for Boyd and Clendenning, has been let to J. J. Frantz Constr. Co., 578 Seymour St.

Residences

Hamilton, Ont.

The erection of an apartment house, on Herkimer St., at a cost of $15,000, is proposed by Thos. Ramsay, Market Sq. E. B. Patterson, 167½ King St. E., is the architect.

Hudson, Que.

Plans for the erection of a $4,000 residence for A. Charlebois, have been drawn by H. Dunlop Morrison, of 454 Old Birks Bldg.

Montreal, Que.

Tenders are being received by the general contractor, Chas. Brown, 4263 St. Catherine W., for roofing the $10,000 residence at Westmount, for R. S. Buck, Dominion Bridge Co., Lachine. Prices will shortly be taken by the general contractor for heating and plumbing.

Plans are being altered for the erection of stores and residences at Verdun, for A. Bailie, Galt Ave., Verdun, at a cost of $15,000, and tenders will be received shortly by the architect, Daniel J. Chighton, Jacobs Bldg., Montreal.

Montreal, Que., Outremont

Plans for the erection of a residence for J. C. Lamothe, are being drawn by G. A. Monette, Room 706, 83 Craig W., who invites separate tenders.

Montreal, Que., Westmount

Tenders on the erection of a residence, on Avenue Rd., will be received by the architects, Hutchison, Wood & Miller, Royal Ins. Bldg., until June 30th.

Plans for the erection of a pair of semi detached residences for Frank Munro, 4910 Sherbrooke St., are being drawn by Angus & Angus, North Bay & Sudbury, Ont. Tenders are invited by the owner. Estimated cost $15,000.

Sub tenders on alterations to the residence of Arthur C. Morris, 316 Kensington Ave., are invited by the general contractors, Murray & McRitchie, 20 St. Nicholas.

Ottawa, Ont.

Tenders are in for the erection of an apartment house at a cost of $15,000, for A. G. Pitaway, 58 Sparks St. The building will be 3-storeys, 6 apartments, solid brick construction, stone and concrete foundation, felt and gravel roofing, electric lighting, hot water heating, pine and birch floors, lime and sand plastering. W. Herbert George, Castle Bldg., Queen St., is the architect.

Plans for a $7,000 residence on Clemow Street have been drawn for M. E. Davis, 202 Booth Bldg., by W. Herbert George, Castle Bldg., Queen Street.

Regina, Sask.

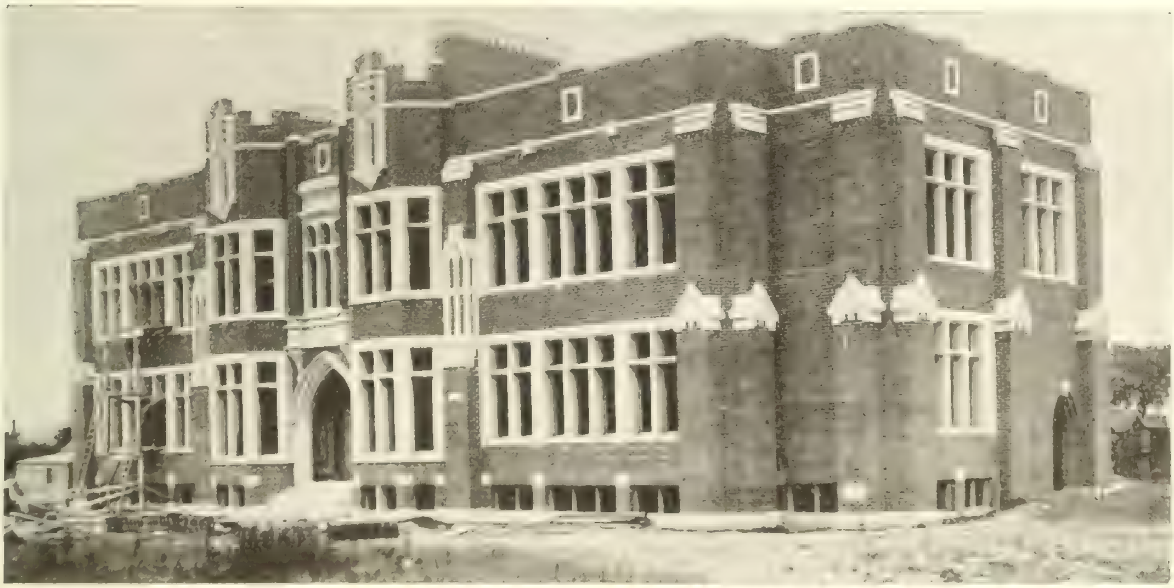
The contract for the construction of a residence at a cost of $15,000 has been awarded to W. G. Dand, 1826 Hamilton St. The building will be 2½-storeys, stone and brick construction, shingle roofing, electric lighting. Owner, J. S. Harold, 4 Victoria Court; architects, Clemesha & Portnall, Credit Foncier Building.

Permits have been granted to G. T.

SUN-TEX

Clay Products

do justice to
Architect and Builder



Architects Page & Warrington North Toronto High School Contractor T Palmer

The above illustration serves to exemplifiy the striking results obtainable from Sun-Tex Brick.

Sun-Tex Clay Products are uniforn in size, color and texture, and free from flaws.

They are the ideal building materials for realizing architectural ideas to the best advantage.

Let Us Quote you Prices

Sun Brick Company, Limited

Traders Bank Building, Toronto

[illegible] Montreal St., for the erection of a [illegible] residence, and to W. R. [illegible], [illegible] Victoria Ave., for a residence to cost $7,000.

Plans for the erection of an apartment block on Leopold Cres., for Cameron & [illegible] Black [illegible] have been drawn by M. W. Sharon, "C" Albert Court, Regina. The estimated cost is $15,000.

The erection of a $5,000 residence on [illegible] St., is proposed by Thos. Brock-[illegible], c/o Y. M. C. A.

Toronto, Ont.

Tenders have been called for the brick work in connection with the construction of a number of 6-roomed residences for [illegible] W. S. Grimshaw, 162 Avenue Road. Owner supplies materials.

Ed. Britnell, of 77 Pleasant Ave., contemplates the erection of an apartment block on Gibson Lane.

Tenders for the erection of 2 stores and apartments on Yonge St. and Belsize Ave., are invited by T. E. Washington, 116 Victoria St.

Windsor, Ont.

Plans for the erection of a $10,000 residence, for H. Neil, 151 Bruce St., are being drawn by Watt & Blackwell, Bank of Toronto, London, who will receive tenders for general contractor.

Winnipeg, Man.

Recent permits include: Daykin Scott Construction Company, for a residence to cost $8,000; G. S. Miller, 709 Home St., for a residence to cost $6,000; B. Robinson, 401 Selkirk Ave., for a residence to cost $8,000.

CONTRACTS AWARDED

Calgary, Alta.

The by-law, providing for extensions to the electric lighting system at a cost of $300,000, which was re-submitted, has been passed by the ratepayers.

Camrose, Alta.

No contracts have been awarded on the extensions to the electric lighting system work being done under the supervision of the engineer, Sydney Appleton.

Hamilton, Ont.

The sub contract for plumbing at the apartment house on Park St. S., being erected for J. A. C. Morrow, has been let to J. N. Luxon, 607 Barton E.

The following contracts on the erection of an apartment house on Bold St. for M. E. Smith, have been awarded: general contract, J. R. White, 515 Spectator Bldg.; masonry, E. G. Mitchell, 89 Sherman Ave. N.; carpentry, Workman & Sons, 1152 King St. E.; painting, John Maxwell, 157 MacAuley E. Tenders are still open for plastering, heating and interior fittings, received by the general contractor.

Imperial, Sask.

Tenders will be received by W. Montgomery, secretary to the New Imperial Rural Telephone Company, for material and construction of a telephone line. Plans and specifications are at the Department of Telephones, Regina.

Montreal, Que., Outremont

The contract for the foundations of residences on Querbes St., for J. A. Chaput, has been let to J. V. Laplant & Co., 142 Bernard Ave. W.

The contract for the erection of a residence for F. P. Dame, 312 Bleury St., has been awarded to Guertin & Bouchard, 110 Parthenais St.

Montreal, Que.

A contract for alterations to the residence of Fabrique St. Edouard, 341 Beaubien St., has been let to Corbeil & Guilbeault, 629 Demontigny.

North Bay, Ont.

The contract for the erection of an apartment house on Klock Ave., for Miss M. Brennan, has been secured by J. P. Quinlan, of Cassells St.

Regina, Sask.

The contract for the erection of a residence on Leopold Cres. for Dr. J. W. Mahan, has been awarded to Constructors, Ltd., 910 Dewdney St.

Sudbury, Ont.

Surveys for the construction of a street railway at an estimated cost of $200,000, have been made on behalf of the Sudbury & Copper Cliff Railway Company.

Toronto, Ont.

The contract for the complete elevator equipment for the new Methodist Book Room has been awarded to the A. B. See Electric Elevator Company of Canada, Limited, Lumsden Building, Toronto.

Tenders close with the Board of Control on July 14th for the supply of one or two 5-ton electric chasses equipped with steel riveted tanks of 1200 imperial gallons capacity, with sprinkling and flushing apparatus complete. Full information can be had at the office of the Commissioner of Streets.

Power Plants, Electricity and Telephones

Dartmouth, N.S.

Tenders will be received by L. K. Jones, Dept. of Railways & Canals, Ottawa, until noon July 2nd, for the construction of the Dartmouth Branch Telegraph Line. Specifications, etc., are at the offices of the Chief Engineer at the Dept., Ottawa, and the Engineer in charge, Dartmouth.

Montreal, Que.

The Cedar Rapids Manufacturing & Power Co., and the Cedar Rapids Transmission Co., Ltd., Power Bldg., have filed plans for the construction of a transmission line from Cornwall Canal across St. Lawrence River, south to the International boundary.

Toronto, Ont.

The Provincial Electrical Commission has decided to purchase the right-of-way from Niagara Falls to Dundas for the construction of a new duplex transmission line.

CONTRACTS AWARDED

Kindersley, Sask.

The Merrington Rural Telephone Company has awarded to the Winnipeg Engineering Co., of 46 Canada Life Bldg., Winnipeg, the contract for the supply of material and complete construction of a telephone system.

Toronto, Ont.

The contract for the installation of an electric travelling hoist has been let by the Board of Control to Northern Crane Works, Ltd., Walkerville, $7,920.

The Provincial Hydro Electrical Commission has awarded the following contracts for dam construction. Hyland, Seriven & Whyte, of Belleville & Smith's Falls, and 77 St. Marys St., Toronto, Dam No. 2. Ambursen Hydraulic Construction Co., New Birks Bldg., Montreal, Dam No. 1, 2,000 ft. long x 40 ft. to 50 ft. high, both reinforced concrete.

Miscellaneous

Hamilton, Ont.

Tenders for the construction of gas mains will be received by Jno. Knox, Bank of Hamilton Bldg., on behalf of the National Natural Gas Co., about July 10.

Toronto, Ont.

The Board of Control has authorized the calling for tenders for two 5-ton electric chassis, equipped with steel riveted tanks and sprinkling and flushing apparatus.

Ottawa, Ont.

The Carlton Constr. Co., Ltd., Union Bank Bldg., is in the market for about 130,000 ft. B.M. 6 in. x 8 in. and 12 in. x 26 ft. long square timber.

SEWAGE DISPOSAL
F. W. THOROLD CO., LIMITED
CONSULTING ENGINEERS
2 TORONTO STREET TORONTO
WATER SUPPLY

SIMPLE
RELIABLE
IAPHRAGM PUMPS
WITH IMPROVED VALVES
(Patented)
Unequalled for pumping large quantities of water by hand power, and for raising sewage, sludge, and all kinds of semi fluids generally. In many sizes and types. Capacities from 1,800 to 14,000 gallons an hour. Workable by hand and mechanical power.
Fully Illustrated Price List mailed free on request to—
HONIG & MOCK, Ltd.
7, MARK LANE, LONDON
ENGLAND.
"The Pump for Emergencies"

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PRESTON ONT.
FINE BANK, OFFICE, COURT HOUSE & DRUG STORE FITTINGS.
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Rates and samples on request.
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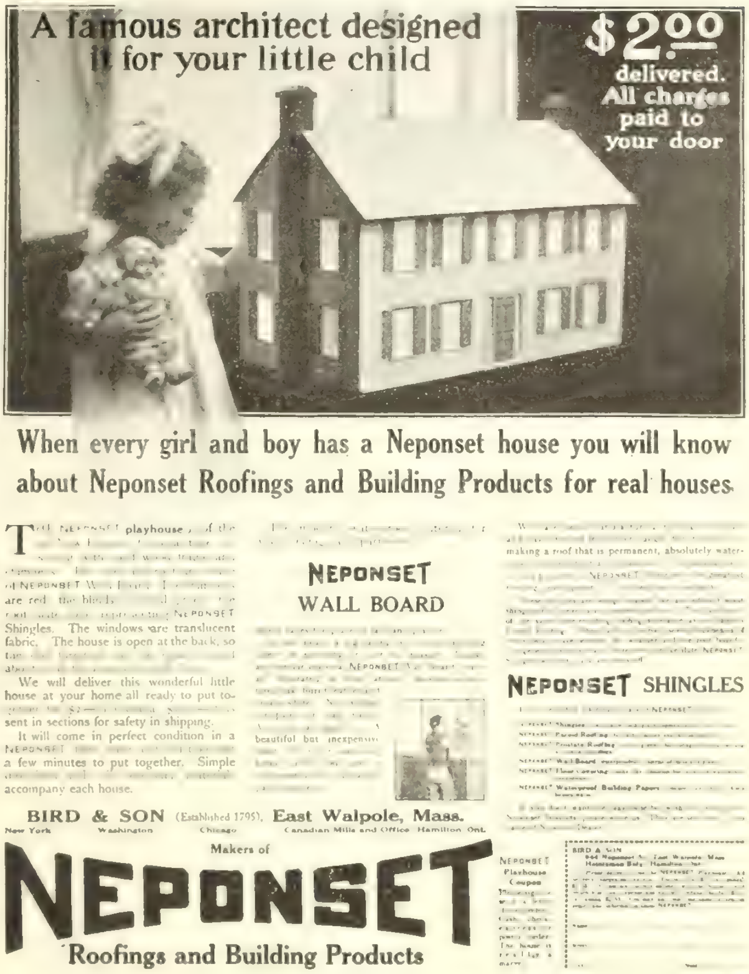
Every reader of this Magazine will be interested in this NEPONSET advertisement.

SATURDAY EVENING POST
(JUNE 20TH)


A famous architect designed it for your little child
$2.00 delivered. All charges paid to your door

When every girl and boy has a Neponset house you will know about Neponset Roofings and Building Products for real houses.

The NEPONSET playhouse [illegible] of NEPONSET [illegible] are red [illegible] representing NEPONSET Shingles. The windows are translucent fabric. The house is open at the back, so [illegible]

We will deliver this wonderful little house at your home all ready to put together [illegible] sent in sections for safety in shipping.

It will come in perfect condition in a NEPONSET [illegible] a few minutes to put together. Simple [illegible] accompany each house.

NEPONSET WALL BOARD

[illegible] NEPONSET Wall Board [illegible] beautiful but inexpensive [illegible]

[illegible] making a roof that is permanent, absolutely water- [illegible] NEPONSET [illegible]

NEPONSET SHINGLES

[illegible]

BIRD & SON (Established 1795), East Walpole, Mass.
New York Washington Chicago Canadian Mills and Office Hamilton Ont.

Makers of
NEPONSET
Roofings and Building Products

NEPONSET Playhouse Coupon

BIRD & SON [illegible]

Name

IT appeared in the Saturday Evening Post, June 20th, and was read by more than 2,000,000 people.

THESE little NEPONSET Houses are now being sent to all parts of Canada and the United States.

THE house is made of our products, and is a symbol of our business—which is the manufacture of NEPONSET Waterproof Building Products — NEPONSET Shingles, NEPONSET Waterproof Building Paper, NEPONSET Roofings, and NEPONSET Wall Board.

THE high quality of NEPONSET Products is well known among builders and contractors, and carpenters, and we believe that this little house will be the means of increasing this reputation with the public at large, especially with those who are building at this time.

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When completed this will be the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally situated
Light on four sides
Passenger and freight elevator
Vaults
Low insurance
One block from four car lines
Floor area, 6,300 sq. feet, each floor.
Building ready for occupancy July 1st.

For further particulars ask

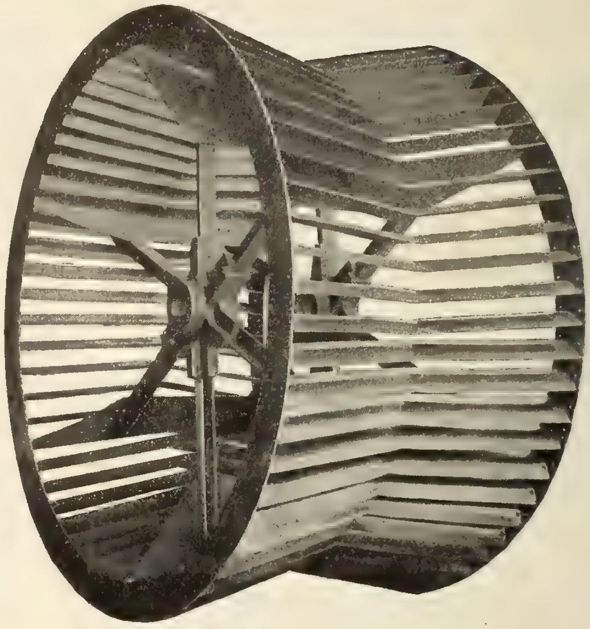
R. A. Donald

Union Bank Building - Toronto

Sturtevant

(REG. CAN. PAT. OFF.)

Union "V" Fan



A Fan of exceptionally high efficiency, with large inlet and blade area, and scientifically designed blades and casing.

Every part carefully and rigidly constructed of the best materials obtainable and by a high grade of workmanship.

A Fan that will give continuous satisfactory service at a minimum power consumption.

Built in Canada by the

B. F. Sturtevant Company of Canada, Limited
Galt, Ontario

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Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915 **Factory: 550 Pacific St., VANCOUVER, B. C.**

These Service Boxes Will Give You Real Service

Arch or Minneapolis Pattern

And they will give you lots of it and no trouble. You will agree with other water works experts that it is the most sensible box made. It is simply unbeatable as a service box.

The Mueller Extension Service Box, because of its superiority, is being widely adopted by Canadian cities.

It is a dirt proof, vandal proof box and we guarantee it unconditionally.

Ask us for prices and descriptive literature.

Made in Sarnia, Canada

H. Mueller Mfg. Co.

Sarnia, Ont.

Makers of high grade Water, Plumbing and Gas Brass Goods.

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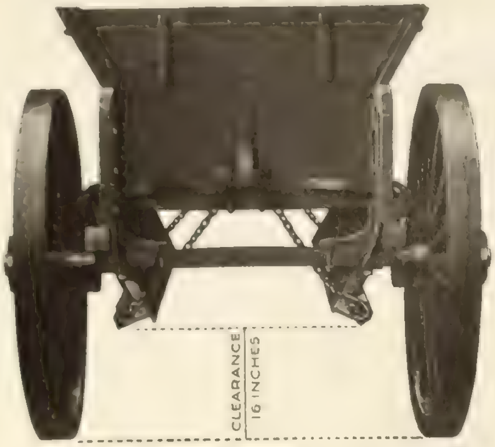

in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.

HARBOUR
Sand-Lime Brick

MADE from clean, pure silica sand and the highest grade calcium lime by the most up-to-date equipment. The result is a brick from outside to core, uniform in density, strength and size.

Ask for further particulars —results of University crushing tests.

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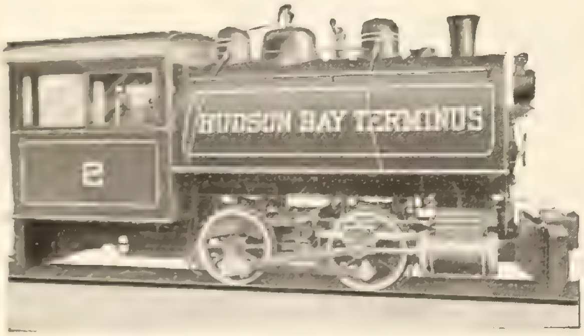
LOW MAINTENANCE COST LOCOMOTIVES



THE life of a locomotive depends upon the care taken in manufacturing. Care in manufacturing increases profits by decreasing cost of maintenance and repairs.

From their long experience in locomotive building, our engineers have earned what is necessary to increase the life and usefulness of this class of equipment. They are qualified to co-operate with you in selecting the locomotive best suited for your work. Let them help you.

MONTREAL LOCOMOTIVE WORKS, LTD.

DOMINION EXPRESS BUILDING, MONTREAL, CANADA

Hamilton Pressed Brick Apartment

Stewart McPhie, Architect.

Because of its deep uniform and rich red color Hamilton Pressed Brick has been selected for many of the leading buildings in Canada.

Our raw material is ideal for our purpose. It is shale rich in iron oxide which gives a fast and pleasing color to the brick.

Specify Hamilton Pressed Brick.

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Rubber Covered
Wires AND Cables

Manufactured in accordance with specifications of the National Board of Fire Underwriters.

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Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

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U.S. Battleship Maine

Bulletin 102 Edition 2
Just off the Press

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Lackawanna Steel Sheet Piling

in the Maine work through the driving, filling of cofferdam pockets, unwatering and pulling of piling offer strong evidence of the success which is achievable in cofferdam and foundation work by proper use of this sheet piling. A copy of this bulletin will be sent to engineers and contractors on application.

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Steel Buildings
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Railway and Highway Bridges

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Estimates furnished on application.

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OUR NEW OFFICE AND WORKS: 1139 SHAW STREET
Main Structural Shop: 130 ft. x 400 ft.
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We build and erect all kinds of Structural Steel Work Roof Trusses, Bank and Office Railings, Stair Work, Elevator Grilles, Fire Escapes, etc.

Over 5,000 Tons in Stock of
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Toronto Structural Steel Company, Limited

Annual Capacity—20,000 Tons.

Ask for list of material on hand for immediate delivery.

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We carry in stock at Montreal, 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

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MANUFACTURERS AND ERECTORS
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IS THE
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The Machine of
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Combine Beauty, Strength and Durability.

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ESTIMATES AND DESIGNS FURNISHED ON APPLICATION

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That will stand the hardest work with least repairs is what is wanted by all contractors.

The Toronto Harbor Commissioners recognized this fact when they ordered MARSH and HENTHORN HOISTS to complete their mammoth contract after having tried out several other makes.

Your inquiries will be appreciated. Let us submit our prices.

We design and build Hoisting Machinery of all kinds.

MARSH & HENTHORN, LIMITED, BELLEVILLE, ONT.

Sales Agents: MUSSENS, LIMITED, MONTREAL

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A BRONZE grill and trim on a fine front door lends a substantial air that is absent entirely without it. Perhaps it is because the banks and churches always have it. Try it on your next good job and see. We'll be glad to furnish catalogues showing many excellent examples, and quotations.

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General Office and Works

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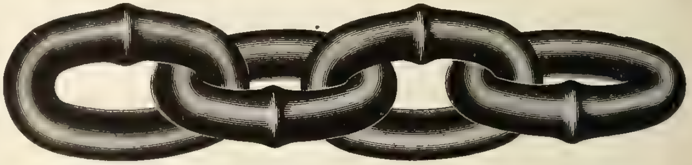
McKinnon Electric-Welded



Chain for Contractors

25% More Weld = 25% More Wear

Sizes 3/16" to 3/4" inclusive.

The only welded chain made in Canada

Sold by Jobbers

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EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

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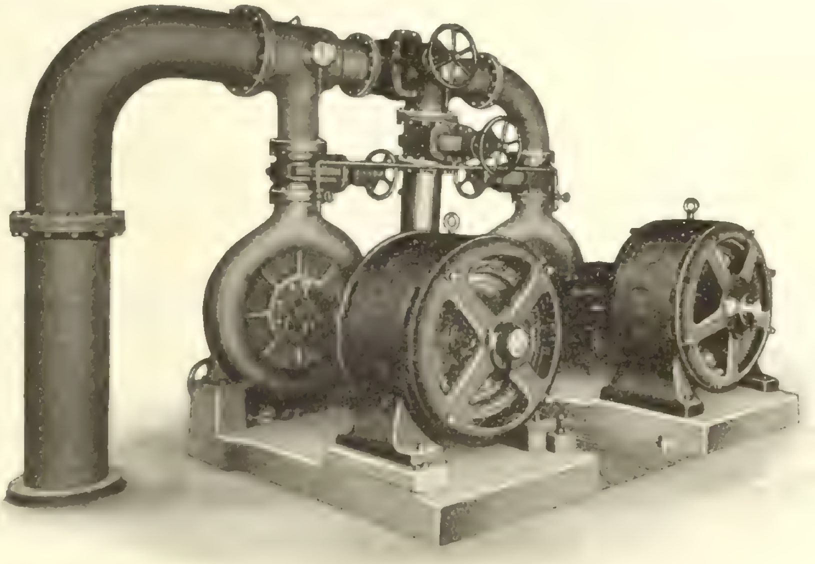

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Towers and Tanks for all purposes.

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Water supply outfits of every description.

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Corrugated Iron is Different When it is "Metallic"

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The selection of the sheets; the Galvanizing, and the Corrugating, are the three points which make for superiority in Corrugated Iron.

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Whether it is painted or Galvanized, straight or curved Corrugated Iron you are interested in, write us for full information and prices.

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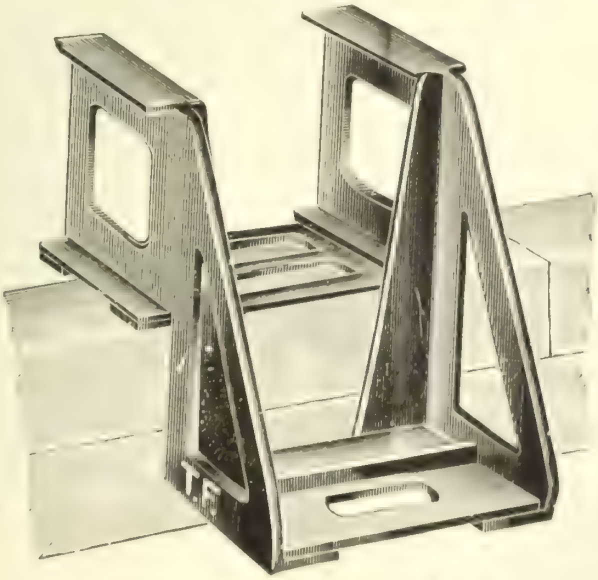

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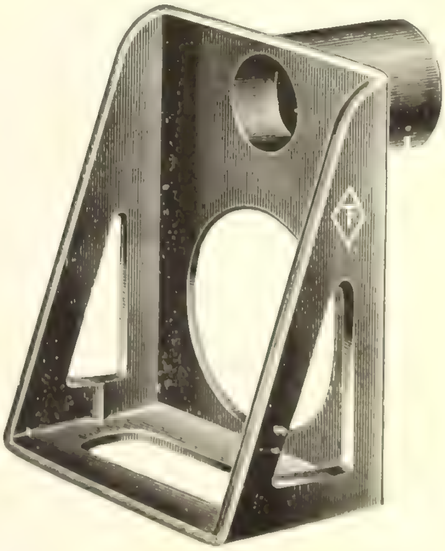

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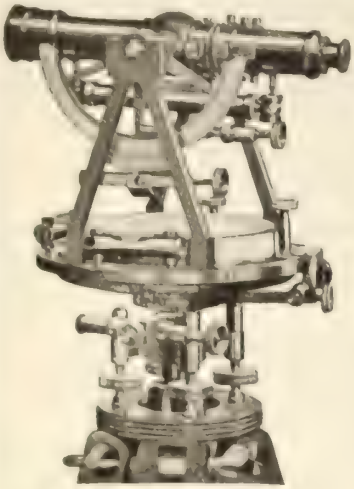

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Price Complete — $186.00
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Your Next Transit!

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Write to-day for our new Booklet, containing detailed specifications of the transit and its attachments, together with prices. A colored illustration shows the instrument in its natural finish.

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TROY, NEW YORK
Makers of Engineering Instruments since 1845
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- Lime
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Concrete Mixers

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A Mix a Minute

Jaeger Machine Co., Columbus, Ohio

Electric Generating Plants

DIRECT RUNNING
AUTOMATIC
OR
STORAGE
BATTERY SETS

Description

Direct Coupled or Belt Driven.

One, Two or Four Cylinder Engines.

Stocked in 50-60, 110-115 and 220 volts.

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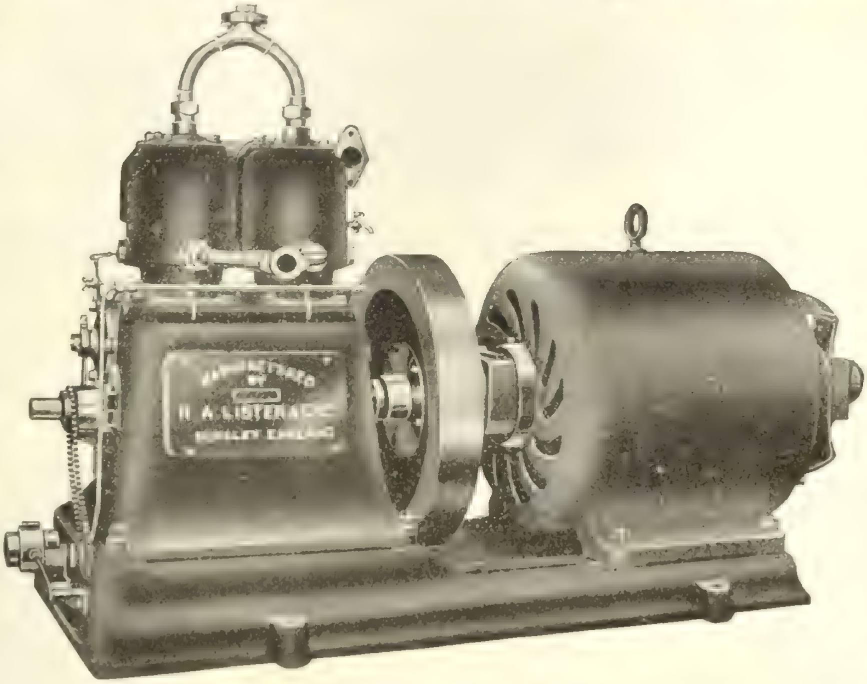

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Running on Gasoline, Natural Gas, Town gas and Kerosene.

Send for Catalogue "E" and Prices.

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More and Better Mortar with Renfrew Lime

The bricklayers who use **"Renfrew"** lime for their mortar claim that it makes more mortar per 100 pounds of lime than any other brand on the market. And when it sets it is like a rock ensuring a permanent and clean-cut job. It is very easy to work with, thus saving time, trouble and money.

You will always find **"Renfrew"** lime to be the same good quality—it has been the same for 25 years.

White Lime - ***Gray Lime***
Stone — ***Drain Tile*** — ***Brick***

Jamieson Lime Company

Renfrew, Ontario

RED
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BRAND
WINDOW
GLASS

GLASS
BENDERS
TO
THE
TRADE

THE TORONTO PLATE GLASS IMPORTING COMPANY, LIMITED

Plate, Window, Figured, Stained, Wired, Bent, Mirror
and Ornamental Glass

DON ROADWAY

TORONTO

The Maritime Bridge
Company, Limited

Successors to

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Manufacturers of

Bridges—Steel Buildings
Roof Trusses — Turntables
Towers—Girders and
Structural Steel Work
of all kinds

Estimates Furnished Promptly

Large Tonnage of Plates, Shapes and Bars in Stock

Office and Plant, **New Glasgow, N. S.**

A STEAM SEPARATOR

of the receiver type is a difficult piece of plate work to make absolutely and permanently tight. That is the reason why we developed our Welded Separator—not a single rivet in its construction, every joint and seam being a perfect weld. The shell is lap welded, the heads are set in by our patented Line Weld method and the necks are attached by our patented Interlock method.

PITTSBURGH VALVE,
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PITTSBURGH, PA.

ATWOOD ENGINEERS FOUNDERS MACHINISTS ATWOOD

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Manufacturers

Flexible and Flange Pipe,
Special Castings and all kinds
of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

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The Canada Iron Corporation, Limited

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Head Office:
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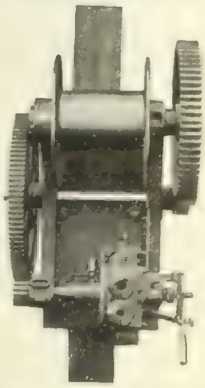
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.



The DAKE

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STEAM CRANE HOISTS
MOTOR CRABS
SWINGING ENGINES

Write for catalog and prices

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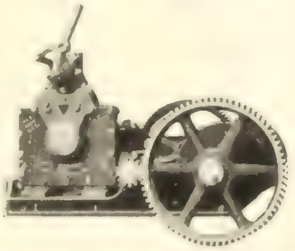

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"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

The Queenston Quarry Co., Ltd.
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Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

HUMBER BRICK YARDS
Lime, Sewer Pipe and Fire Brick

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Conduits

for Interior Construction

Conduits Company, Limited
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Toronto - Canada

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LARGEST MANUFACTURERS IN CANADA OF

CAST IRON PIPE

every size for Water, Gas, Culvert or Sewer, Carried in Stock

Lake or Rail Shipments **Offices, Works and Docks, TORONTO**

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ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons
STEEL BRIDGES AND BUILDINGS

460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE

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Representatives for Canada:
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No job too small, nor too large where a Sasgen Derrick cannot be used to your advantage.
Our derricks are built of the best crucible steel and malleable iron fittings.
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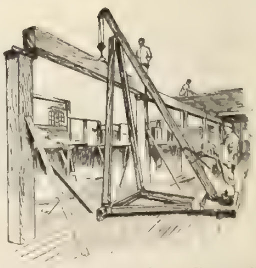

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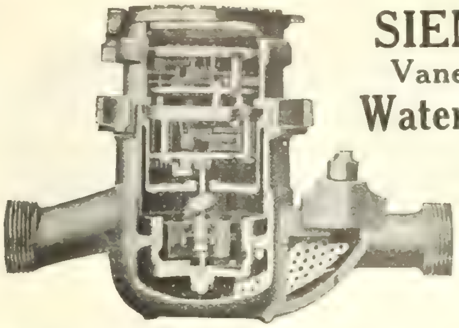

SIEMENS
Vane Wheel
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Dry
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The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

Literature on request.

Siemens Company of Canada
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MEXICAN EAGLE ASPHALT
TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
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7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
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BELL AND SPIGOT STEEL PIPE

COATED AND WRAPPED

Made in sizes from 2″ to 10″ inside diameter with different thicknesses for varying pressures.

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Iron, Tube & Lead Co., Limited
TORONTO, ONT.

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STEEL TANKS

Three Rivers, Quebec
Wayagamack Pulp and Paper Co., Ltd.
50,000 gallons. 149 feet to top
120,000 " 100 feet to top

Hemispherical and Segmental Bottoms

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HOPE STEEL SASH

Embodies points of merit that make it worthy of your consideration. Scientifically designed and economically constructed it recommends itself to discriminating architects and engineers.

HOPE SASH has demonstrated its superiority in thousands of buildings in Canada and the United States as well as other parts of the world. It is a sash with a reputation for excellence back of it.

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Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service. We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

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are well adapted for and will readily drive the largest and heaviest kinds of piling that is at present being used. Recent tests made with one of our No. 9 pile hammers in driving heavy wooden sheeting through foreign material—gravel, fill, etc.—showed that it would do more effective work than a 6,000 pound drop hammer. The tests further demonstrated that rapid and uniform piston blows were more efficient than the heavy and infrequent blows of the drop hammer, and that it was possible to attain the same penetration in the miscellaneous material without splitting or "brooming" the piling.

Exclusive Agents in Canada

CANADIAN ALLIS-CHALMERS

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No. 7 Pile Hammer in leads of a locomotive crane. Without any special base arrangement the hammer is used for driving both sheeting and round piles.

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WIRE CLOTH AND WIRE GOODS

Concrete Bonding
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Local Agents Wanted in

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Water Filters
1,000 to 1,000,000 Gallons a Day

Refrigerating Machinery
1/4 to 60 Ton Daily Capacity

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4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
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302 McGILL BLDG., MONTREAL, P. Q.

Current Prices of Building and Engineering Materials

General Review of Trade and Market Conditions

THE constructional field in Toronto as [illegible] evidence of increasing vitality [illegible] the beginning of June, and market conditions generally are fairly active. The [illegible] building permits taken out is usually an [illegible] of building work. The [illegible] show that for the five months ending May 31 the total value of permits [illegible] considerably below that of the corresponding [illegible] the decrease representing more [illegible] dollars. For the month of May the number of permits issued was largely in excess of the corresponding month of 1913, and yet the total value was considerably lower, the explanation of this being the increase in small residential buildings. That conditions in the [illegible] beyond doubt, but the fact remains that improvement will be slow and a permanent change for the better will not materialize as quickly as many had anticipated.

With regard to brick, some manufacturers in Toronto and district report brisk business, with stocks practically depleted and plants working at capacity. The market for paving brick, however, is quiet, notwithstanding that prices have been well maintained. The market for cement, crushed stone, sand and gravel has stiffened considerably in the last couple of weeks, and although there is a noticeable absence of large orders the volume of business in regard to cement is reported to be a trifle ahead of this time last year. Lime, however, is below last year's level and the movement in steel is very weak, although there are hopes of its picking up to some extent in the near future. For lumber of the leading grades the demand is fairly steady. Generally speaking, there is evidence that people are advancing more cautiously owing largely to the conditions which have operated during the past year against indiscriminate building. This factor is one which business men are convinced will lead to greater solidity of industrial conditions in the end.

At Montreal, complaints are numerous regarding the condition of the building trade. Some sections are fairly busy, but on the whole business is not satisfactory. There has been labor trouble owing to the strike of some Union carpenters, who ask for an advance of 2½c an hour and an eight-hour day. The newly-formed General Contractors' Association have been in conference with the officials of the Union; the result was a twofold offer—to pay the 45c an hour demanded for a nine-hour day in the summer and an eight-hour day in the winter, with a stipulation that there should be a three years' agreement; or failing acceptance of this, the contractors were willing to refer the dispute to a conciliation board. After consideration, the men accepted the reference to a conciliation board, meanwhile returning to work at the old rate. Some of the smaller contractors are not favorable to any advance, as they assert they can obtain any number of men at as low as 32½c an hour. The Union bricklayers, plasterers, and stonemasons have asked for an increase of 5c an hour and an eight-hour day.

Cement is in better demand, and although no extensive orders are being placed, the small orders are coming in at a good rate. Business in bricks is also picking up, due to some extent to the large number of houses going up. Other building supplies are in rather slow request, crushed stone being a notable instance of poor trade. Many orders for explosives have come to hand. In lumber, there is not a great deal doing, and some descriptions are feeling the competition of the poorer grades of American pine. The order for five-and-a-half million feet of lumber to be used in the construction of the big dock at Port Levis, P.Q., has been placed with Mason, Gordon & Company, of Montreal. It will be shipped from British Columbia via the Panama Canal. Owing to the dry weather and the consequent low water conditions, preventing logs being driven, it is expected that there will be a diminution in the cut.

At Winnipeg the building situation remains practically the same as it was at the time of our last report. There is fair general activity, with a moderate call for all materials of construction. The clay products plants in the vicinity of the city report a continuation of activity and a sustained steady demand. Business in the lumber industry is rather more active as a result of the satisfactory completion of seeding in the country, although there is still much room for improvement in this industry. Structural steel is in only fair demand, and cement, crushed stone and gravel are moving in normal volume. Paints and oils are in fairly active demand, the recent fine weather throughout the prairie provinces having had a stimulating effect upon their movement. There are few market changes to report since our last review. Putty has decreased in price, and white lead has advanced. Sand is also being quoted a shade higher, while gravel has dropped 5 cents per yard. Lumber prices remain unchanged.

At Vancouver the market conditions have undergone some improvement since the beginning of June, due to the inauguration of a fairly extensive programme of street paving in different parts of the city, and the consequent increased demand for such materials as are required in that particular branch of municipal activity. The movement of lines such as crushed stone, sand, gravel, Portland cement and paving brick has been noticeably stimulated and will probably continue at fair strength during the balance of the month. With respect to steel and iron, local firms report only an apathetic call for rods and bars, few enquiries being received aggregating large tonnages. Prices remain firm on small tonnages, but some concessions have been noted on desirable specifications covering but few sizes, in a number of instances the difference quoted being as much as 15 or 20 cents per 100 lbs. on the prices current. While the condition of this market is at present somewhat uncertain, a slight betterment is anticipated later in the summer when it is practically certain that building construction will become more active at points situated at or convenient to the coast. A similar situation exists in regard to most lines of straight building supplies, business being rather quiet at time of writing, but likely to improve shortly. The fact that within the next month or six weeks Vancouver contractors will have an opportunity of figuring on various building works aggregating well over a million dollars in value, should undoubtedly effect a considerable improvement in the situation. The demand for paints and oils has moderated to some extent in the last two weeks and the outlook for the remainder of the month appears to be rather quiet. Local enquiry for lumber is about the same as last month with prices unchanged.

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11.50 to $12; wire-cut brick for foundation work, $9.50 to $10; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $32; sand-lime brick, $8.60, King Edward siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, **$33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce** flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. **or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5** in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. **extras $4; N. B. clears $3.45; No. 1 pine lath** $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; **twisted and deformed, $2.50; structural sections $2.50 to $3.**

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: **4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.**

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) **f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less** 62 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, **dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; tur**pentine, in bbls., 69c.

MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft.

(Continued on page 106)

RAILS BILLETS

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY LIMITED

BAR STEEL

Warehouse Stocks:
SYDNEY, N. S.
MONTREAL, QUE.
TORONTO, ONT.
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Sales Offices:
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WIRE NAILS and other WIRE PRODUCTS

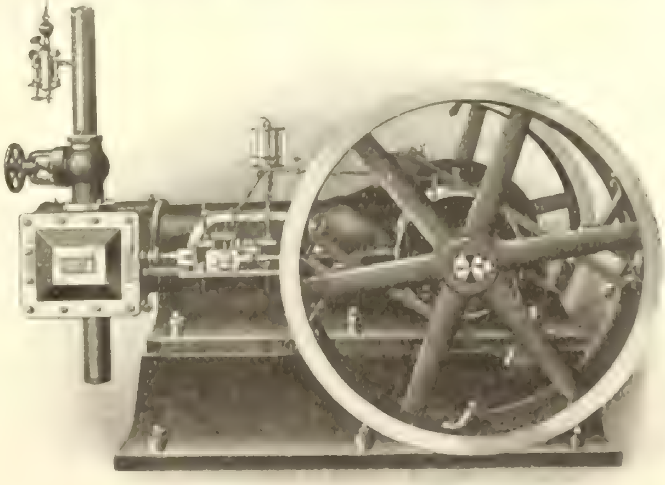
Victor Centre Crank High Speed Automatic Engines

Suitable for belt drive or direct connected to electric generator.

The frames are of the heavy duty enclosed type.

Balanced side valves are used on all sizes.

Prompt shipment on all sizes from 65 to 350 H.P.



Maximum speed regulation is obtained by the Hardwick Patent Governor.

Lubrication is from a large central reservoir with sight feed showing the exact amount of oil fed to each point of the engine. The finish and workmanship is of the best.

Agents in Canada for the Erie Engine Works. Quotations and complete specifications upon application.

Rock & Power Machinery, Limited

Head Office:—12 King Street East, Toronto

Branch Offices:— Vancouver Montreal Halifax Cobalt Sudbury and the King Edward Hotel, Toronto

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

[illegible] ; 104 [illegible] $4.62, double $5.12; 12 ft. single $5.16; [illegible] $5.66, 14-ft. single $5.70; double $6.20, 16-ft. single $6.24, double $6.74; 18 ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82, 22-ft. single $8.32; double $8.82, 24-ft. single $9.32; double $9.82; 26 ft. single $10.32; double $10.82; 28-ft. single $11.32, double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x [illegible], 25c extra; 3/4-in. x 3/4-in. x [illegible], 50c extra. Boiler plates—1/4-in. thick and heavier, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25, 28-in. $4 per sq. [illegible] less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

LUMBER (BUILDING MATERIALS)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $45.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car-load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 [illegible]

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

CRUSHED STONE, SAND, GRAVEL, ETC.

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

Paints and Oils—White lead, ground in oil, $9.00 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

SEWER PIPE, STEEL AND IRON

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

Steel—Round bars, $2.40 per 100 lbs.; square twisted, $2.50 per 100 lbs.; channels, angles, beams and plates, $2.90 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

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Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

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Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

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Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

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White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls, 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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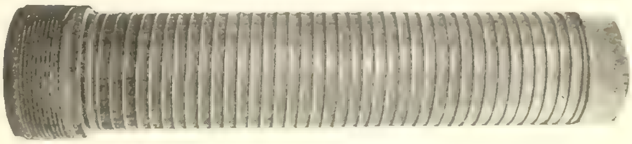

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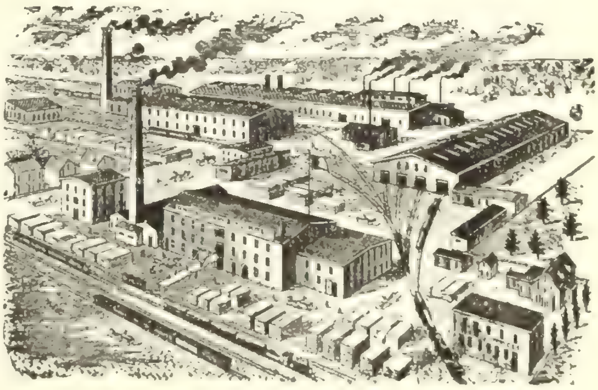

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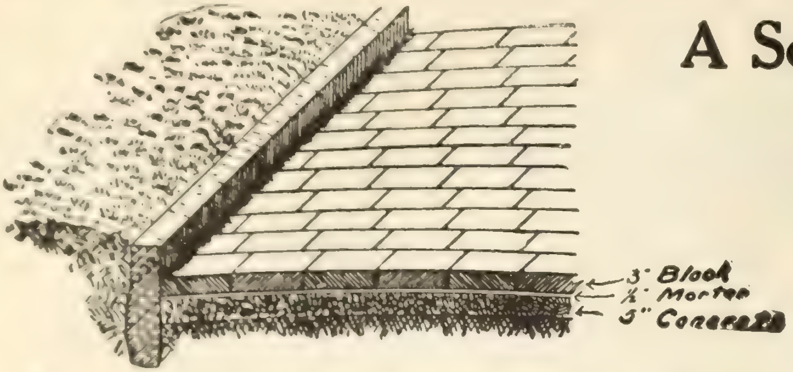

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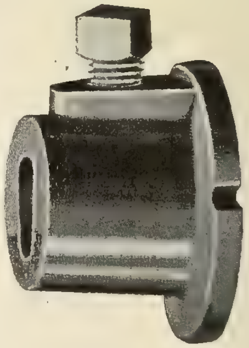

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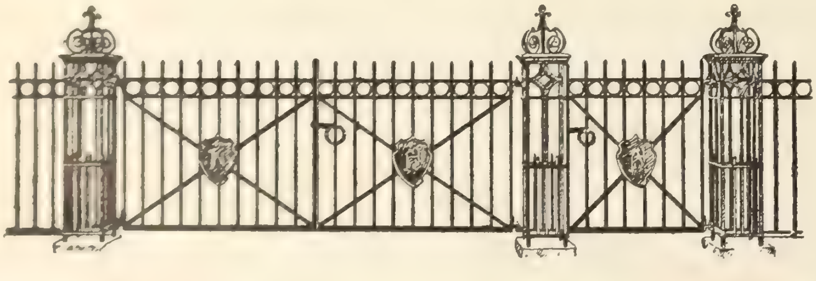

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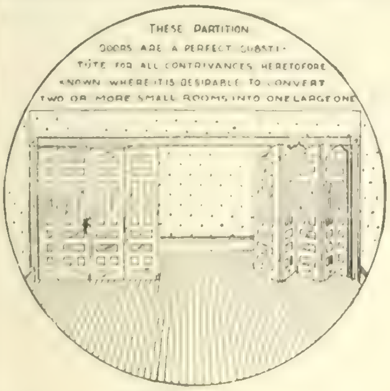
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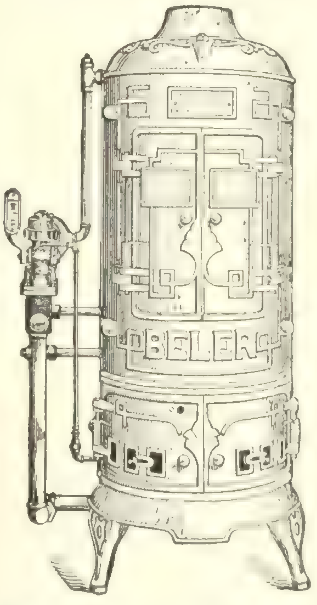

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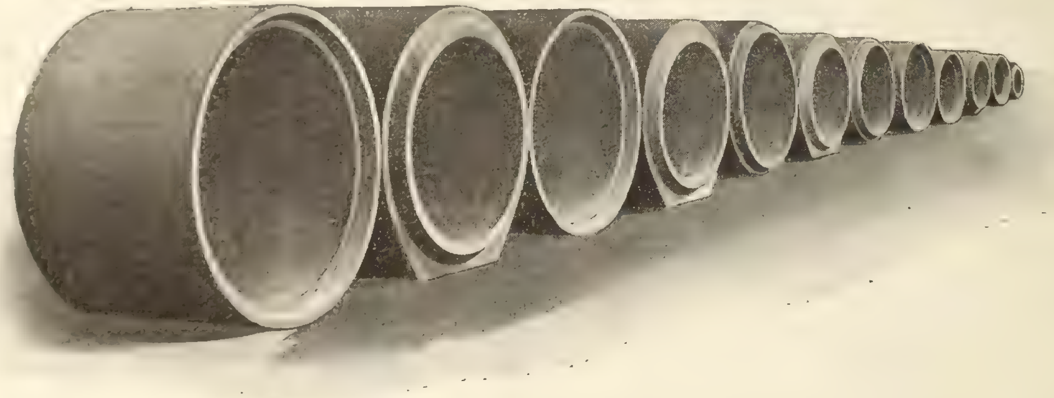

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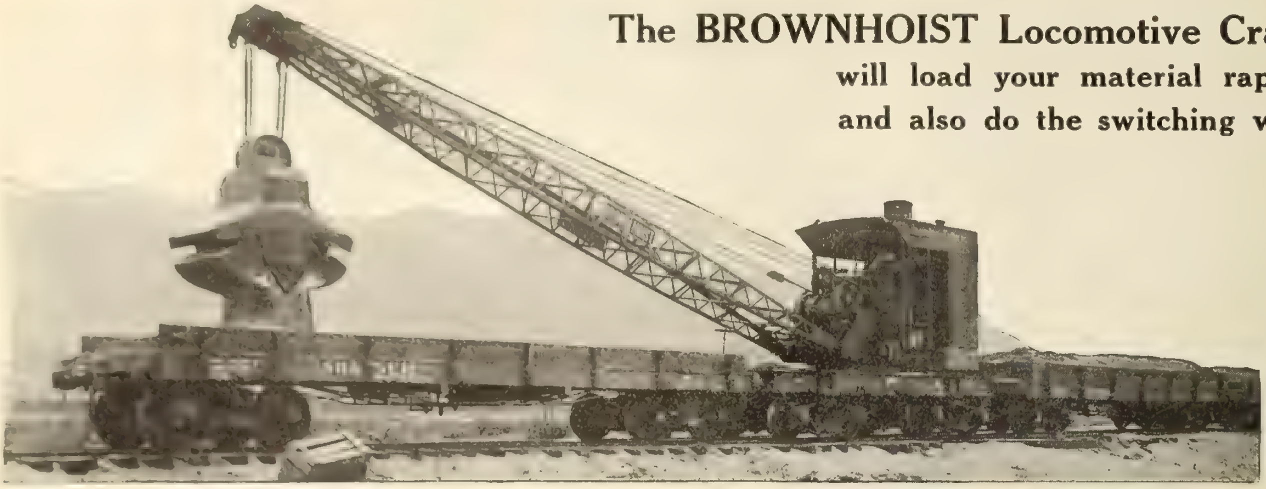

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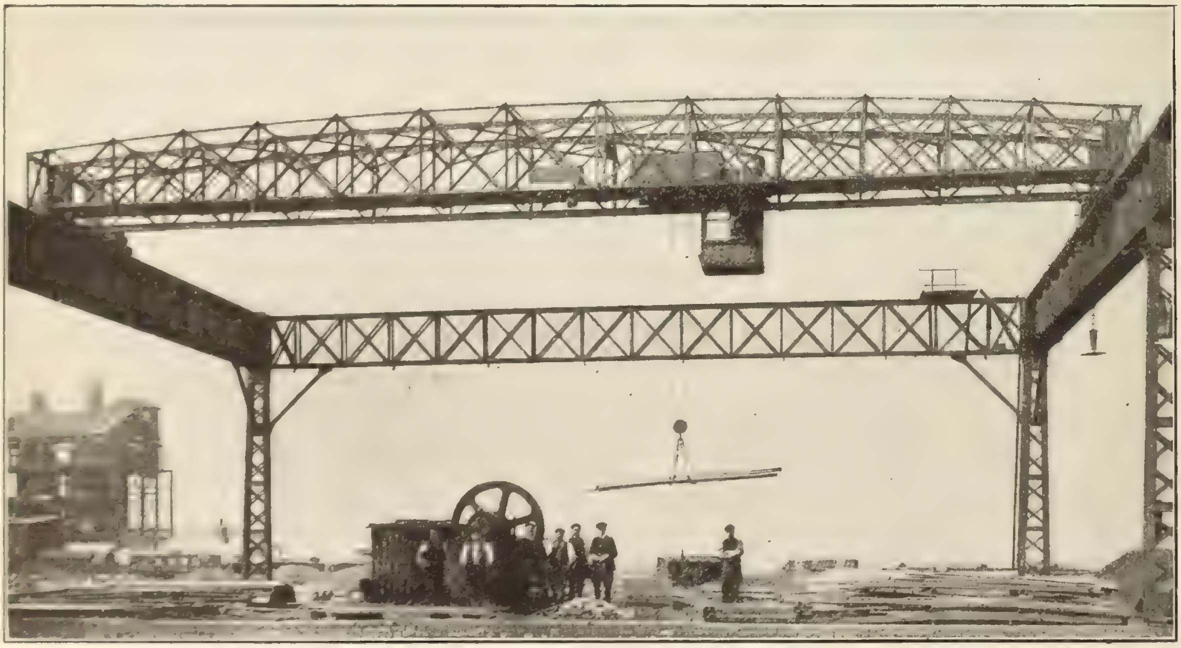

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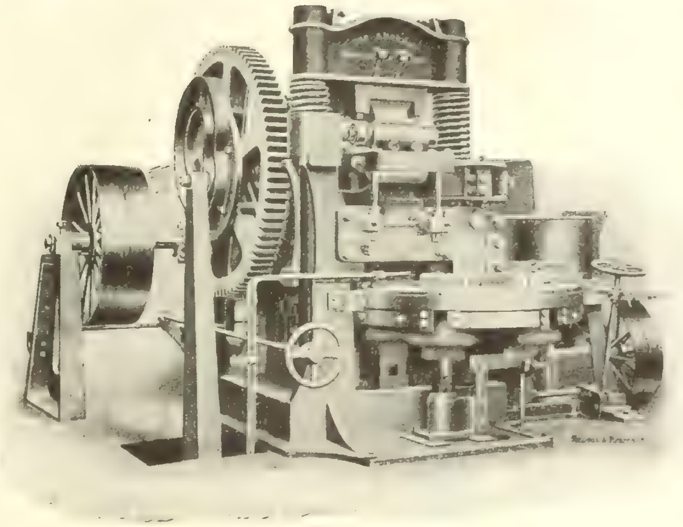

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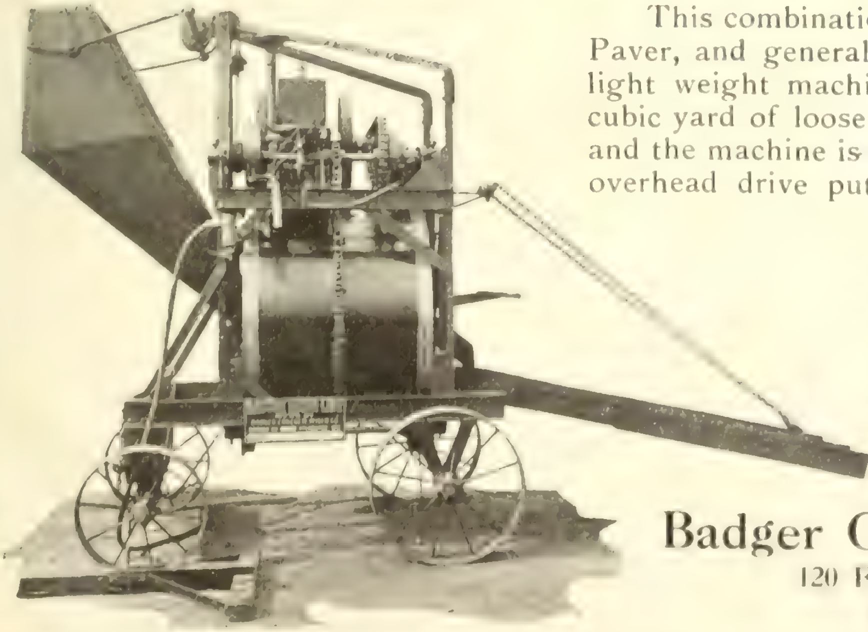
Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

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Milwaukee, Wis.

Buffalo Single Cylinder Double Acting Power Pump

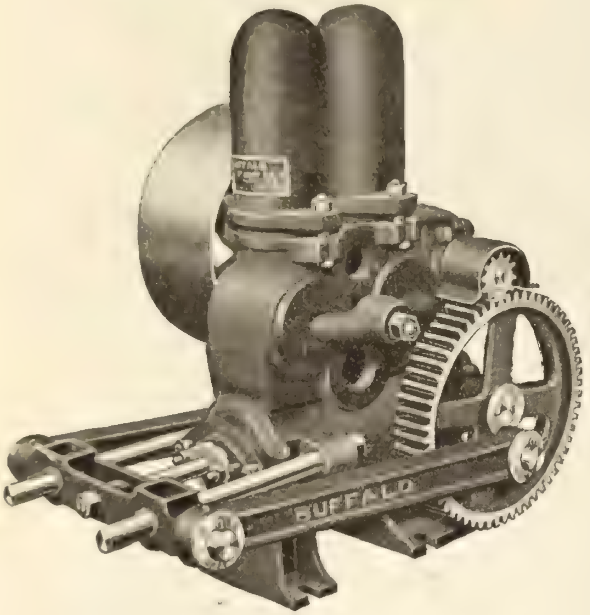

Fig. 401

The power pump illustrated is a distinct departure from the older competing designs now on the market. It will be noted that both the suction and discharge openings are above the cylinder. Because the suction valves are above the water piston the water contained cannot leak out when the pump is stopped. In other words the pump **always stays primed** and will immediately pick up its suction after a long period of rest because the cup leathers will not have dried out. This design is by far the best for handling water through long suction pipes and for the greatest convenience of operation. Two large air chambers are provided directly above the discharge valves where they are doubly effective and as they are easily detached the discharge valves are easily accessible. The suction valves are reached through two cover plates both of which may be taken off by removing one nut.

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Pump cylinders are brasslined, valves, valve seats and gland are brass; piston rods are brass fitted.

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Built in sizes 10 to 100 gallons per minute.

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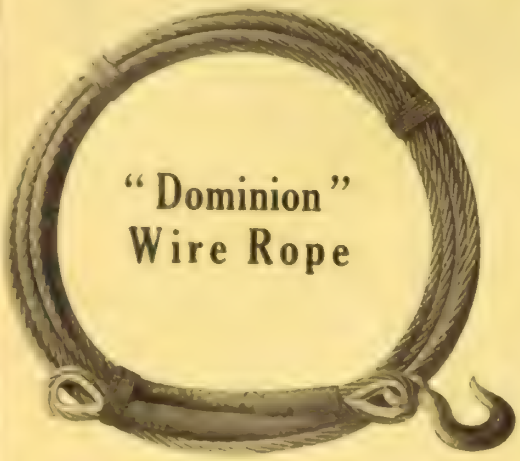

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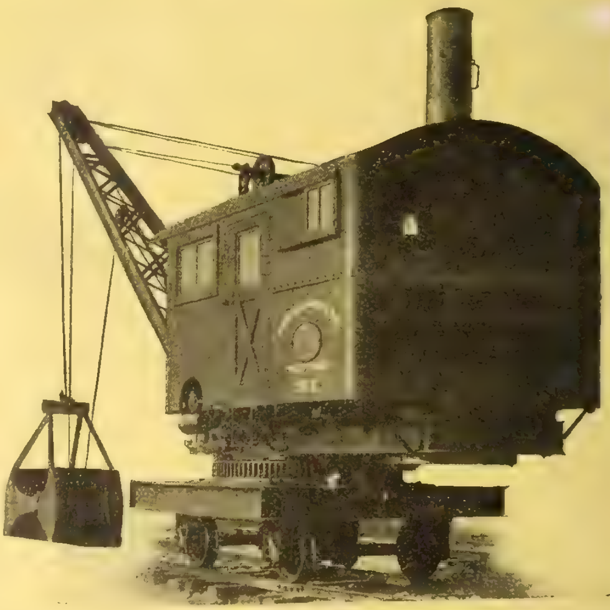

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